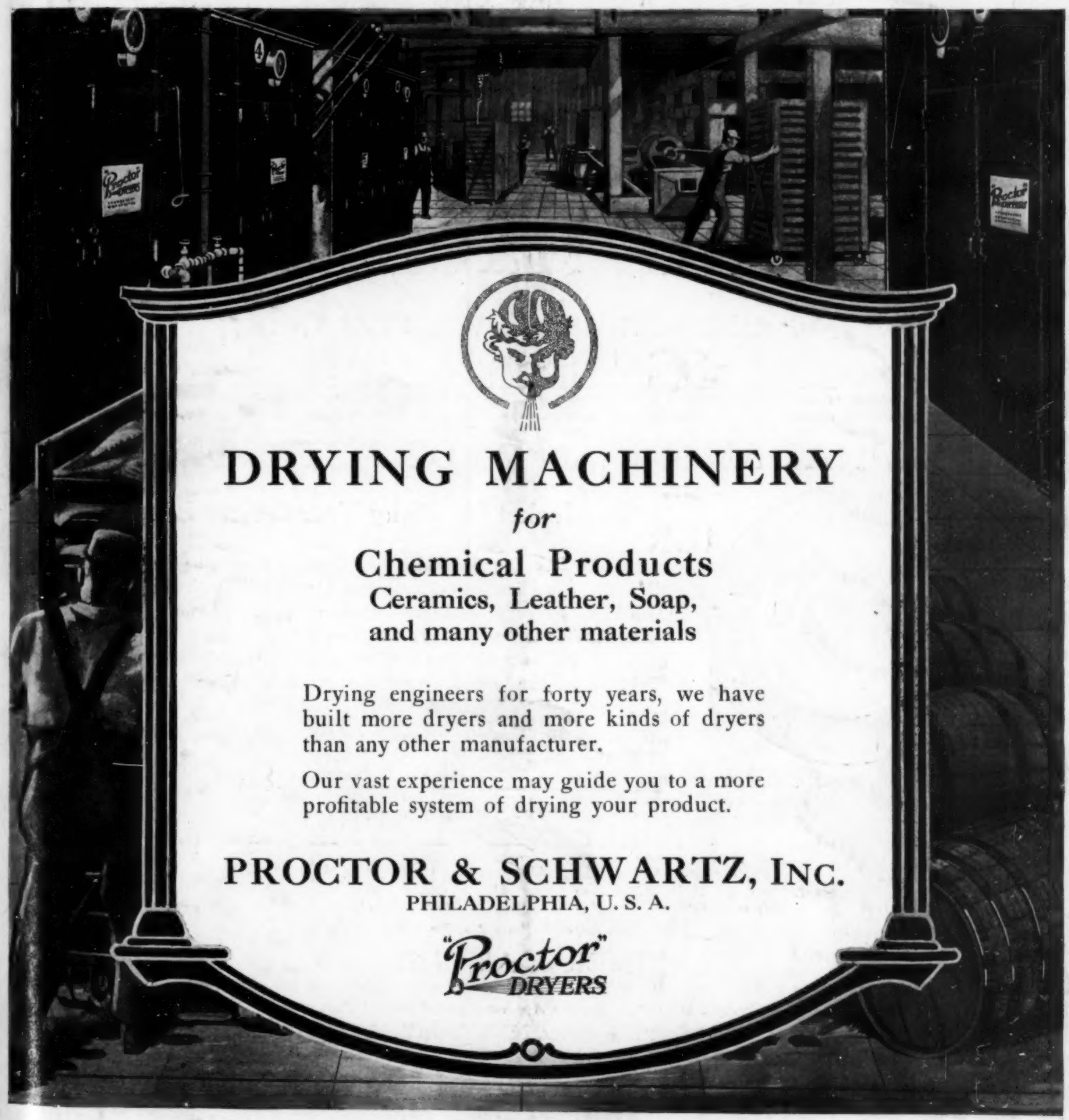
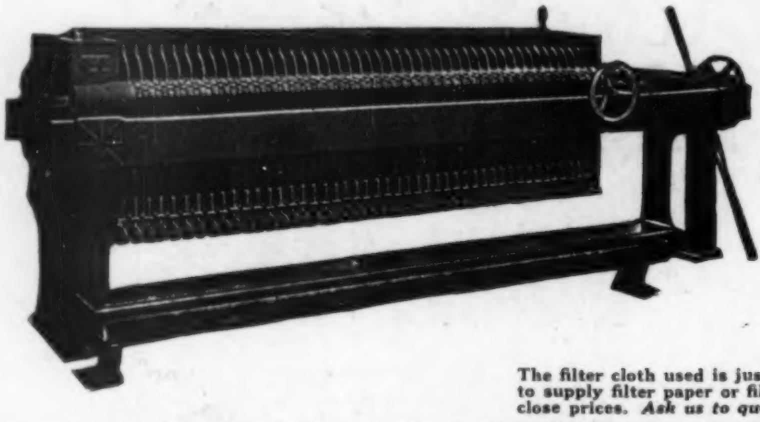
June 4, 1923

McGraw-Hill Co. Inc.

25 cents per copy

CHEMICAL & METALLURGICAL ENGINEERING





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CHEMICAL & METALLURGICAL ENGINEERING

A consolidation of
ELECTROCHEMICAL & METALLURGICAL INDUSTRY *and* IRON & STEEL MAGAZINE

H. C. PARMELEE, Editor

Volume 28 — New York, June 4, 1923 — *Number* 22

Future Progress in Steel Making

MOST of the "big men" who attend the meetings of the American Iron and Steel Institute go to hear Judge GARY'S estimate of the trade conditions, to meet their business friends and competitors, and to discuss with them the state of the union. Then there are a large number of plant managers and engineers whose main interest is to renew acquaintances and find out what the other fellow is thinking about and doing. Finally, there may be found a larger number of men who do business with the other groups (or would like to) who are there because it is a good place to be.

In such a gathering one anticipates that science and technology would occupy inconspicuous seats. However, they are very useful to fill in between the president's opening address and dressing time for the banquet. They are quite distinguished and above any suspicion which might survive from "Gary dinners," and it is well that they are useful in these circumstances, as in many others. If it were not for the technical program—prepared often by mandatory invitation—a large part of our huge metallurgical industry would be inarticulate.

Knowing the origin of some papers on the program and guessing at the careful scrutiny they receive before release, it is perhaps permissible to place more weight on a statement that "only through unremitting and untiring research can chemistry continue to serve the steel industry as it has in the past" when coming from a metallurgist with the Steel Corporation than if it came from a chemist with the Bureau of Standards. Can it be that the remark reflects the tardy realization that the steel companies in America are very remiss in studying the essence of their processes? Few are so backward that they have no investigations of any sort under way, but in nearly every instance they are working on minor plant troubles or disputes with customers.

But there seems to be an undercurrent of opinion that we are on the very brink of revolutionary changes. The minute it is admitted that the conventional steel plant has nearly reached its theoretical possibilities, it immediately follows that the next improvements will come through radically different methods. If, for instance, the mechanical gas producer cannot be appreciably improved, when may we expect the "slagging gas producer" gasifying coal at ten times the rate? If the iron blast furnace has reached its limit, is not that very fact ushering in the new metallurgy which will exist when oxygen is produced for five dollars a ton? (One hears that two thoroughly trustworthy organizations are guaranteeing less than that figure!) Or for that matter, cannot the principles of ore concentration, so well known in the West, be used to produce a very pure iron oxide, and this be reduced directly to high-grade steel without the expensive refining operation?

Truly, it would be well for the large producing interests to gather to themselves men of vision and widest scientific training, so that they will be forewarned and prepared against discoveries which can turn a million dollars worth of steel plant into a few thousand dollars worth of junk.

Bio-Chemical Engineering

SIGNIFICANT REMARKS made recently by Dr. C. P. STEINMETZ indicate the interrelation of the sciences and the need for a catholicity of viewpoint on many of the research problems of the day. For example, economical sugar production demands more than a consideration of the final phases of processing; much of the success of the beet-sugar industry in recent years has been due to the intensive cultivation of the plant, by which the yield of sugar per unit of weight has been increased largely. The distinguished engineer of the General Electric Co. spoke of biological engineers, citing LUTHER BURBANK as the dean of a new professional group. There is nothing incongruous in the new classification. If one accepts the verdict that an engineer is essentially creative, it must be admitted that Mr. BURBANK is more entitled to the use of the appellation than is the individual who manipulates levers, or who directs the process of exterminating insects, or who moves furniture, or who turns a deaf ear to our pleas for heat in winter time. There is a close connection between biology, chemistry and the supply of fuel for the human frame.

Comparatively recently we have begun to realize the connection between biology and the supply of ordinary fuel, which suggests that future power requirements may be met in whole or in part by the intensive cultivation and the economic utilization of plant life. The simplest manner of taking advantage of this possibility is to permit the sun to function at maximum efficiency, for light is an essential to the process. We know that deposited crystals need be removed from an evaporator as they form, else efficiency drops rapidly; similarly, no estimate of the possible value of natural biological products is possible without taking into consideration the advantages of scientific harvesting. Thus it has been proved that seaweed may be cut from shallow-water deposits at frequent intervals, whereupon Nature replenishes the store of raw material for the possible supply of potash, iodine and other byproducts. Recent biochemical research has shown that at least one type of seaweed, in the presence of an ample supply of carbon dioxide, can fix atmospheric nitrogen and form carbohydrates and protein; that bacteria unconnected with

leguminous plants can nitrify the soil; that the wheat plant can assimilate free nitrogen from the atmosphere. Scientific progress in this direction indicates that we are probably on the threshold of discoveries of importance, discoveries that may profoundly affect the problem of nitrate production for fertilizer purposes; and it behooves the chemical engineer, for economic as well as for technical reasons, to keep in close touch with the advances being made in a closely related science.

A Self-Starter In Automotive Research

A FEW YEARS AGO there was scarcely an industry so backward in scientific interest and acumen as the automobile industry. But there came a day when the manufacturers began to sense that a pink-powder puff and a cigar lighter in the body of a car would no longer serve as selling arguments. There was less talk about the "perfect car" that used 4 or 5 per cent of the energy of the gasoline and wasted the rest. This change in attitude is traceable almost directly to the achievements of a single laboratory out in Dayton, Ohio.

The other night at a dinner it was our privilege to sit beside C. F. KETTERING, head of the General Motors Research Corporation. We found him neither solemn, nor glum, nor cryptic. He is, according to the slang of the day, a live wire. To hear him talk for an hour is a liberal education. The incidence of a successful mind on research is always interesting and for the benefit of our readers we want to quote from memory a few of his observations as well as a story or two told us by one of his associates. A problem in hand included 18 months' work with negative results. The report was 300 pages long. When it was brought to Mr. KETTERING he was not interested; said he "wouldn't give a damn for it"; it was not complete. "There are 300 blank pages on the backs of this record," said he, "and there is room to put down the reasons why you did not succeed. Please see that they're there before you bring it back to me." This very study developed the key to the solution of an important problem in the automotive industry. It brought out the fact that a material was needed that was not available. The next and rather simple step in the procedure was to find that material.

He has no patience with the substitution of mathematics for physical chemistry. Mathematics, he insists, is a tool of no value whatever until you have an idea. "If I want to build a garage," said he, "I don't need mathematics until I have made up my mind what I want, where my garage is to be built and how the windows and doors are to be placed. I must see it in my mind's eye first. Then it is time for me to begin to measure, not before." It goes without saying that mathematics as a tool is in constant and active use in the Dayton laboratory.

It is easy to understand why those who work with him love to do so. It is lively business—exceedingly lively business. He expects everybody to think for himself, and not to dawdle about it either. To him science is all one great subject so interrelated in its various parts that the research chemist who cannot grasp a problem in mechanics is not an adequate chemist, nor is the engineer who cannot sense a problem in chemistry a complete engineer.

The story is told of an address he made to a class of graduating engineers in one of the leading universities. He offered handsome fellowships to any members of the class who could answer a simple question within 60 seconds. "Why," he asked, "does a sharp knife cut better than a dull one?" There was no answer forthcoming. He expects a reason in mechanical philosophy for everything that happens.

He encourages opinions, wants lots of them, but will brook no confusion between an opinion and a fact. The distinction between the two is very clear in his mind, and he does not seem ever to forget it.

TOM MIDGELEY, of whose work in overcoming the knock in internal-combustion engines we have published considerable already, said: "We had worked 2 years on this problem without results. Then Mr. KETTERING furnished the hell that gave us the necessary religion to enable us to worry out our salvation."

One doesn't need champagne or any other stimulant to liven up the talk if C. F. KETTERING sits across the table; especially if one is interested in research. The difficulty is to keep the sparks alight and to remember them all when the evening is over.

Reserves of Natural Nitrate

BY PUBLICATION last fall of an exhaustive report on the economic value of the nitrate in Californian deserts, the U. S. Geological Survey set at rest many rumors as to the possibility of starting domestic production somewhat on the lines of the Chilean nitrate industry. The conclusions reached indicated that nitrate occurs in the United States in insignificant amount, which it would not pay to recover. The possibility of discovering deposits other than those that are already known is so remote as to be of negligible significance. It is, therefore, a matter of considerable importance at the present time that industry form a correct impression of the reserves of this most important raw material.

The policy of underrating the resources of a competitor is one that is likely to prove a boomerang. At the annual meeting of the British Association for the Advancement of Science at Bristol, England, in 1898, Sir WILLIAM CROOKES, noted physicist, shared honors with the fake explorer, LOUIS DE ROUGEMONT, in startling the world. The latter held his audience spellbound while he recounted an amazing series of adventures in a country which, it was discovered later, he had never even visited. Sir WILLIAM predicted an almost immediate nitrate famine, consequent on the early exhaustion of the deposits of caliche in Chile. His national and international reputation served to add weight to his contention, with the result that the prophecy has reverberated for 25 years, being used as a text by writers of all types and aspirations and for purposes too numerous to mention. During the war it served to awaken interest in preparedness, which was justifiable; but it is pertinent to note that after all the great conflict was won with Chilean nitrate, and that the South American industry in the meantime has pursued the even tenor of its way. Apart from the effect of economic fluctuations caused by the war aftermath, in spite of steadily increasing output, the Chilean deposit has shown no evidence of strain, much less of exhaustion, since the utterance of Sir WILLIAM'S prophecy.

During the past 2 years an attempt has been made in the technical press of the United States to present the facts, as determined by first-hand experience, and to explain the real situation in Chile. The conclusions that

have withstood the acid test of criticism suggest that the air of secrecy which has shrouded the industry has been due in large measure to the deplorable technological standards prevailing on the pampa, consequent on the retention of inefficient methods of beneficiation and inadequate scientific control. The lack of definite statistics as to the technical operation of the plants has synchronized with a professed ignorance of the exact amount of caliche available for future mining, which, however, is easily explicable: The cost of the investigation necessary would be prodigious, and the Chilean Government would be stupid to incur the expense. Further, the introduction of efficient, large-scale methods of beneficiation and modern ore-handling equipment will permit the addition to the known reserves of an immense amount of low-grade caliche the economic value of which is now considered negligible.

It is generally conceded by engineers who have visited the country that the Chilean deposit is too gigantic and too scattered to permit statistical estimate of quantity or to justify pessimistic opinion as to probable life. Recently a change of tone is noticeable in published statements. For instance, Sir E. J. RUSSEL, the director of the Rothamstead Experimental Station, writes in *Discovery* that the caliche has been estimated to last from 200 to 300 years, adding that "the period is not long in the history of the world." True; but even after a heavy discount, the estimate is one that will occasion no alarm to the Chilean authorities. If it is necessary to pare the export tax, which brings so much to the national coffers, to meet competition with synthetic nitrate, the government will doubtless transfer the tax to copper, which, thanks to the utilization of efficient large-scale methods, is now being produced at an exceedingly low figure in the Chuquicamata plant. For the immediate future, therefore, Chile has no qualms.

In the United States, however, the problem is different. Adequate preparation against national emergency would be a fundamentally wise precaution; and this can be insured only by the maintenance, in successful operating condition, of sufficient synthetic nitrate plants to insure independence from foreign supplies in the event of international complications. It is only remotely possible that such plants could compete with the natural product under ordinary conditions, after considering the possibility of the removal of the export tax and the cheapening of production by the introduction of modern methods; but this fact should not deter research and the formulation of a definite policy in anticipation of every possible national contingency.

At some time in the future all the nations of the world will be self-supporting in regard to nitrate: the principal source of the raw material—air—will be available to all on equal terms. Those countries favored with ample water power and possessed of skilled technologists will fare best. At such time the United States will have no cause for apprehension. In the meantime it is pertinent to recall Germany's action before the war in purchasing, cheaply, immense amounts of nitrate from Chile; statistics show an importation into Germany of over three quarters of a million tons per annum prior to August, 1914. The productiveness of her land was so increased that the yield of wheat per acre was raised to 35 bushels, as compared with 15 in the United States, and the yield of potatoes mounted in about the same proportion. It may be suggested that a concentrated output permits cheaper harvesting, and that the amount of Chilean nitrate being imported into the United States at the present time might be increased with advantage to all concerned. It has also been proposed that large stocks should be purchased and stored in the arid regions of this country. In any event, the American chemical engineer should be encouraged to lend his aid in the efficient recovery of nitrate in Chile, to remedy the deplorable technical conditions that exist; so that reduced cost of production would stimulate increased utilization, more efficient farming and a market for American equipment.

Reducing the Fire Risks In Chemical Plants

TO THE average manufacturer, particularly in our chemical engineering industries, the underwriter of fire insurance is a bugbear whose periodic visits to the plant are filled with many anxious and heart-sinking moments. This attitude of fear and trepidation may be the result of sad experiences in the past or it may be the manufacturer's idea of expediency, but in any event it only hints at the real difficulty in the situation. What is most needed is a community of understanding between the industry and those who are endeavoring to indemnify it against the ravages of fire.

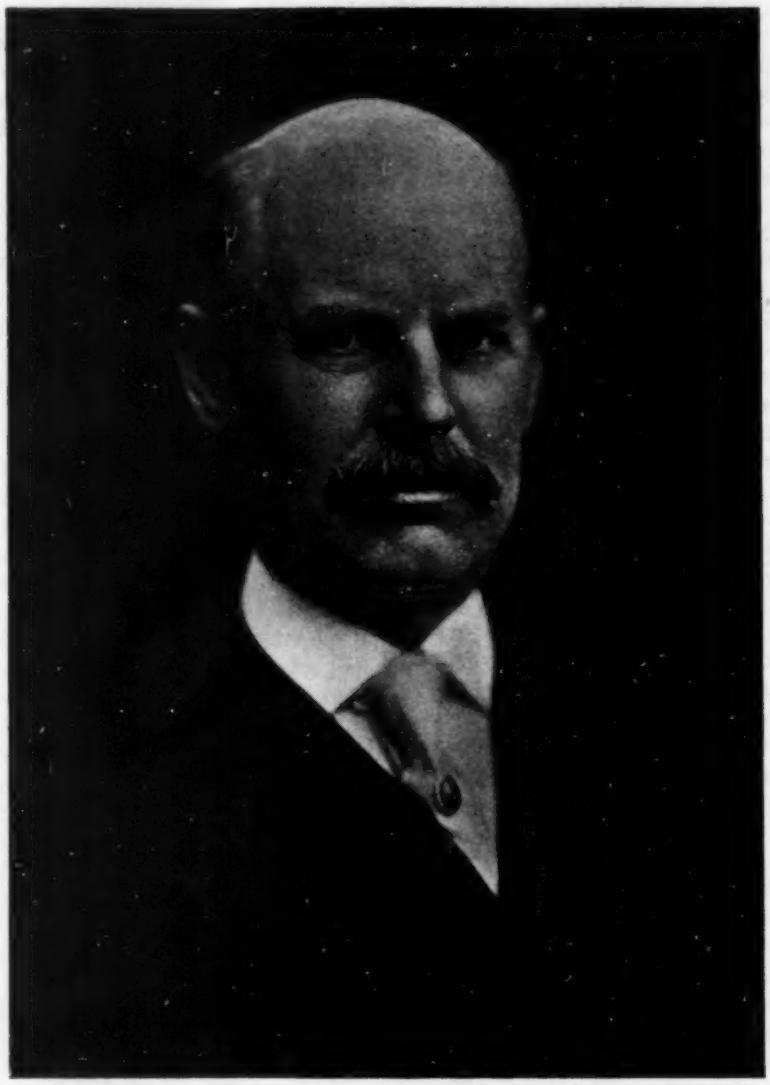
Our manufacturing procedures are as a closed book to the average underwriter. Discouraged at the complicated chemical reactions involved and the manufacturer's reticence in explaining them, the insurance man often finds himself thrown back on his own resources and judgment. Naturally he is likely to err. For example, in at least one fire insurance company of which we have knowledge, any sublimation process is regarded as an obstacle to the acceptance of a chemical plant. The reason for this is that during the war, when haphazard methods were more generally in vogue, a certain manufacturer heated his sublimers over an open fire and in the disaster that followed his plant was completely destroyed. The folly of condemning all sublimations merely because of such an unfortunate experience is, of course, obvious, but it calls attention to a neglected duty on the part of our technical men. They hold the solution to problems of this kind in their own hands. They understand the conditions to be met and were they to co-operate with the underwriters in deciphering these fire hazards, they could pave the way for remedial measures of benefit to both the insurer and the insured.

An interesting example of what can be accomplished in this way was shown in the case of a dye plant the manufacturing procedures of which involved only a single hazardous operation. The underwriter correctly judged that the entire plant was thus endangered and he recommended and collected an unusually high rate for the insurance. Later on the case came to the attention of the chemical engineer in the plant, who immediately recommended that the dangerous process be removed from the other operations. As a result of this segregation the plant became a better fire risk, the insurance was materially reduced and this in turn had its effect as a considerable saving in manufacturing costs.

The fact that in these individual cases frank discussion between the technical man and the insurance company has proved so effective suggests the possible benefit that might come from concerted efforts on the part of our industries. Appropriate committees from our trade associations or technical societies should find here a proper field for constructive study and co-operation.

Edward G. Acheson

Whose achievements in the domain of industrial electrochemistry have written a new chapter in the Romance of Technology.



THE early careers of men of achievement are especially interesting to the Professors of Can-do in the great University of Hard Knocks. For the more particular benefit of these we shall record a few notes on Dr. Edward G. Acheson while he was Himself in the Making.

His father was manager and part owner of a blast furnace at Washington, Pa., where he was born. Will Stewart, a neighbor, was studying medicine, but had studied chemistry, and Edward thought he would like to follow the latter profession. In 1872 he was recalled from school to go to work in view of impending bad times which his father sensed. Dr. Otto Wuth of Pittsburgh refused to take the 16-year-old boy into his laboratory as an apprentice, because "there was nothing in chemistry." Ten years later substantially every iron and steel works in the district had its own corps of chemists.

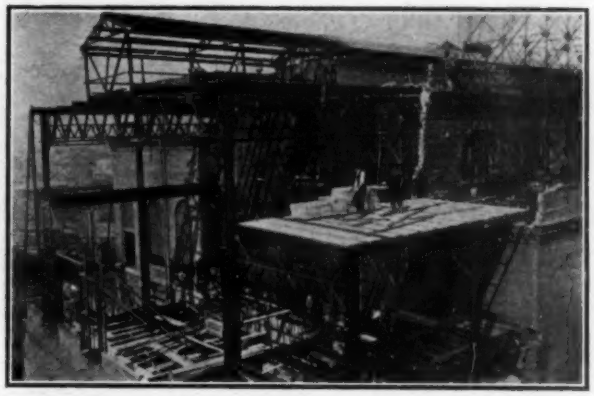
Young Acheson at 23 "took to" electricity, and at the end of a year, against all friendly advice, he came to New York. He spent weeks hunting a job and finally with money almost gone he landed as a draftsman in the Edison establishment at Menlo Park.

When work was slack in the drafting room he undertook to develop a notion he had of a new meter to measure currents. Mr. Edison came along and asked what he was doing. "I don't pay you for this," he exclaimed. "Suppose it turns out useful. Then if I adopt it you'll say I stole your invention!" "No sir," replied young Acheson. "I'm working here on your time and you pay me for it. Anything I bring out is yours!" And soon thereafter he was turned loose in the Edison laboratory.

A senior fellow-worker at the Edison laboratory was Dr. Edward L. Nichols, later of Cornell University. He had studied with Helmholtz and been a research fellow at Johns Hopkins. They took rooms jointly with a clergyman at Metuchen, 2½ miles away, and on their walks back and forth discussed physics and chemistry. Dr. Acheson got his scientific education through conversation with carefully selected friends and from directed reading. In the Romance of Technology our readers will find no more interesting chapter than the story of his career, of the inventions that resulted in carborundum, siloxicon, aquadag, oildag and artificial graphite, and of the many distinctions and honors in science that have been accorded him.

Manufacture and Application of Lightweight Concrete Slabs

BY ALAN G. WIKOFF
Assistant Editor, *Chem. & Met*



WHILE the setting of concrete involves complex chemical reactions, the process proceeds satisfactorily without chemical supervision, so that the production of cast concrete forms by a chemical company is at once an indication of some new or unusual feature. For some time the Porete Manufacturing Co., Newark, N. J., has been manufacturing, for construction purposes, concrete slabs containing so many air cells that their weight is only about one-third that of the corresponding solid slabs. The necessity for chemical control in this case arises from the method that has been devised for making the concrete porous.

FIG. 1—GENERAL VIEW OF THE PLANT

A material that is solid at ordinary temperatures but melts easily in hot water is formed into round pellets about $\frac{1}{16}$ to $\frac{1}{8}$ in. in diameter, by allowing the liquid material to flow through a perforated plate into a tank of cold water. The pellets are discharged upon a screen to drain and when the requisite quantity has been prepared the screen is dumped into a mixer below. Cement and sand are added so that the final proportions are three parts of cement, one of sand and seven of pellets. After mixing thoroughly with a measured amount of water, the concrete is dumped into a hopper provided with a measuring device which delivers a uniform volume of concrete to the forms. These are of steel so constructed that they may be taken apart to facilitate removal of the completed slabs. Before filling, a piece of expanded metal reinforcing is placed in the form and supported evenly about $\frac{1}{4}$ in. above the bottom plate. After the concrete has been leveled off with a hand trowel the filled forms are placed in racks, where they remain until evening. In order to regulate the setting process, the racks are then placed in a tank of warm water over night. An electric hoist mounted as a traveling crane is used in handling the racks.

By morning the concrete has set sufficiently so that the slabs may be removed from the forms, which are then cleaned and made ready for further use. In order to render the slabs porous it is, of course, necessary to get rid of the pellet material, and since this is relatively much more valuable than the other constituents of the concrete, it is desirable to recover it as completely as possible. The combined step of removal and recovery is thus a very important part of the manufacturing process. The slabs are sealed in an oven which can be heated externally by a coal fire and which is also provided with connections for admitting steam to the interior of the oven. As the slabs warm up the pellet material melts and runs out through an opening in the bottom of the oven into a sump. The remaining pellet material is removed by introducing superheated steam, which carries the vapor through an outlet in the top of the oven to a water-cooled condenser. By means of an automatic temperature regulator it is possible so to condense this mixture of steam and vapor that the pellet material remains liquid and collects with the material already in the sump. The recovered material is pumped from the sump to the pellet-forming machine, thus completing the cycle.

Part of the building in which Porete is manufactured is shown in Fig. 1. In the right foreground are the tanks that regulate the setting of the concrete; back of these is the oven and to the left of the oven the condenser for recovering vaporized pellet material.

PROPERTIES AND APPLICATION OF PORETE

The finished slabs are 24x32x1½ in. and weigh about 30 lb., including the expanded metal, while a solid concrete slab of the same dimensions and com-

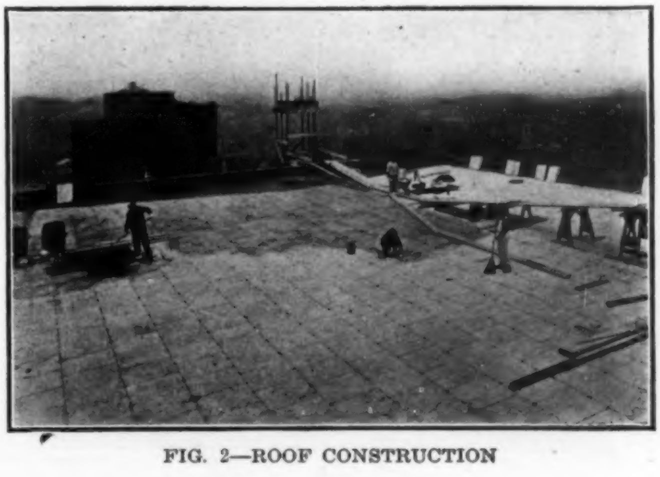


FIG. 2—ROOF CONSTRUCTION

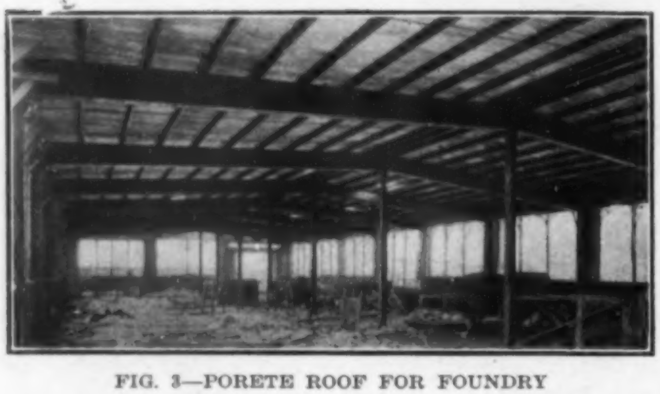


FIG. 3—PORETE ROOF FOR FOUNDRY

position would weigh about 75 lb. This is equivalent to about 55 lb. per cu.ft., or 6 lb. per sq.ft. of surface. These slabs are admirably adapted for building purposes, for sidings, roofing or flooring, as they may be nailed directly to wood studs without injury, or clipped to steel beams or purlins. The side of the slabs which was in contact with the steel form is comparatively smooth and solid, whereas the other presents the appearance of concrete sponge. In construction work this porous side is kept toward the outside, thus furnishing an excellent base for the application of stucco. For roofing and flooring the surface is treated with a cement finish. Because of the light weight of this material the roof members of a steel frame structure may be of a much lighter construction than would otherwise be required.

Although light in weight, the slabs are very strong. They are designed like a reinforced concrete slab. The steel near the bottom takes care of the tensile stresses, and the cement finish that is applied to the top and makes a perfect bond with the rough surface takes care of the compressive stresses produced by the bending moment. In the way in which the slabs are used on roofs they will carry a live load of 40 lb. per sq.ft. (which is required by most building departments), with a factor of safety of over 6. In tests, specimens have broken at 300 lb. per sq.ft. on a 32-in. free span. Figs. 2, 3, 4 and the headpiece illustrate the use of Porete for roofing and flooring.

Because the slabs are reinforced with a surplus of steel, a greater amount of cement finish on top will increase their strength. For instance, in concrete floors, after a ½-in. thickness of cement is applied to the top of the slabs, this finish makes them strong enough to carry heavy floor loads of 125 lb. per sq.ft. with a factor of safety of 5, where beams are set on 32-in. centers. This gives a very lightweight, shallow and strong floor construction, especially valuable for mezzanine floors.

FIG. 4—NAILING PORETE TO WOODEN JOISTS

On account of the cellular structure of Porete, it makes a much better heat-insulating material than solid concrete. Tests made by Lichtin[1] indicate that the heat-insulating value is about the same as that of wood. This is an additional feature which makes Porete desirable on roofs.

The saving in steel on account of the light weight of Porete is especially pronounced on a long span construction, and Porete roofs have been used and are in the course of construction on power plants, factories, public garages, theaters, schools, etc. The company expects soon to have other exterior building units, where light weight and nailability combined with weatherproofness are desirable features.

This material would seem particularly valuable in the construction of roofs and floors of large and small buildings around chemical plants, as the material is resistant to the effects of heat, steam and many chemical fumes. No interior finish is required, the slabs being simply nailed to wooden studs or clipped to the beams and given an outside coating of cement. The building in which Porete is made is an excellent example of this type of application. As will be noted in Fig. 1, the sides and roof are formed of Porete slabs clipped to a light steel framework.

For data used in the preparation of this article, the writer is indebted to Ernest Walter, vice-president of the company and inventor of the process, and R. D. Hudson, superintendent.

Action of Sulphurous Gases on Nickel-Chromium Alloys

In discussing alloys resistant to corrosion before a recent meeting of the Faraday Society, J. F. Kayser said that practically all manufacturers claim that their nickel-chromium alloys are quite resistant to the action of sulphur in furnace gases. He tested several such commercial alloys, and some would withstand the action of steam, carbon dioxide, carbon monoxide, ammonia and even pure oxygen for indefinite periods without scaling. Mixtures of those gases were also found to be quite harmless upon most of his samples. The introduction of either H_2S or SO_2—particularly the former—proved, however, to be fatal to even the highest grade nickel-chromium alloy.

Strong Bronzes

The Engineer notes in its issue for May 4 that the Brentford Foundry has produced a very remarkable bronze (or rather brass) called "coronium." Its composition is 80:15:5 Cu:Zn:Sn, and is apparently similar to the Oreide (80.5:14.5:4.85:0.1 Cu:Zn:Sn:Pb) noted in Professor Campbell's list of alloys, and is closely kin to screw brasses containing up to 1½ per cent lead. Sand castings have given 36,000 to 40,000 lb. per sq.in. breaking strength. Taking special precautions in pouring and cooling, specimens are reported having ultimate strength of 50,000 lb. per sq.in., elongation 38 per cent in 2 in., and contraction 37 per cent.

[1]James J. Lichtin, "Relative Heat Conductivities of Some Insulating and Building Materials," *Chem. & Met.*, vol. 24, p. 388, March 2, 1921.

Manufacture of Activated Carbon

BY ARTHUR B. RAY
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The many industrial applications of the new types of highly activated carbons recently made available indicate that the manufacture of these carbons is destined to be an important industry in the United States. There is, however, no one type of carbon that can be universally effective for all purposes. All so-called activated carbons contain more or less active carbon (which is regarded as a fairly definite physical entity), but they also have extremely important secondary properties of density, strength, hardness, etc. For industrial gas and vapor absorption, for instance, a granular activated carbon which is mechanically strong, relatively dense and highly active is required. The soft, finely pulverized, highly porous and generally moderately active decolorizing carbons are practically worthless for this purpose. In order to supply the carbons most effective for the different industrial applications the manufacturer must by proper selection of activating method and raw materials be able to control the activity and also the secondary properties such as hardness and density of his product.

THE diversified and extensive industrial applications of activated carbon are causing this product to be manufactured in larger and larger quantities. The National Carbon Co., Inc., of Cleveland, Ohio, began in 1919 the manufacture of the type of activated carbon particularly suited for adsorbing gas and vapors, and also the types adapted for purifying and decolorizing liquids and catalyzing various reactions. At the present time it is the only concern in the United States producing all these types in commercial quantities. Several other plants are now engaged in making the type of activated carbon that is suitable only for purifying and decolorizing liquids. The demand for the gas-adsorbing type of activated carbon for use in extracting gasoline from natural gas, recovering solvents, abating odors, purifying gases, etc., is growing rapidly, because its relative commercial value in comparison with oils, cresols and other absorbents is becoming widely recognized. New commercial uses for this unique material are being found constantly, and it is predicted that in a few years many industries will consider it indispensable. The demand for the type of carbon used in purifying and decolorizing liquids is also increasing, as its relative efficiency in comparison with boneblack and fullers earth is gaining general recognition.

Activated carbon is a comparatively new product. A number of so-called decolorizing carbons, which are carbons activated to some extent, have been on the market for several years, but the new and very different product now being produced and used commercially for gas and vapor adsorption was developed during the war in answer to the demand for a material of great adsorptive capacity for use in gas masks. The discovery of the fundamental factors involved in its production is without doubt one of the outstanding scientific achievements of recent years. But gas mask carbon, although more highly active than any carbon produced before its development, does not effectively decolorize and purify many liquids. The fundamental reasons for this and the essential characteristics of highly activated carbon which will most effectively decolorize and purify various types of liquids were later discovered, however, by the writer.

One distinction should be clearly made at the outset to avoid possible confusion. *Active* carbon, as will be seen in the subsequent discussion, is regarded as a fairly definite physical entity of well-defined properties. The so-called *activated* carbons of commerce are not pure active carbon, and may vary enormously in porosity or density, strength, hardness, etc., by reason of the associated inactive carbon structure. Yet upon these secondary and incidental properties may depend the commercial usefulness of the carbon for a given industrial purpose. It is now known that the carbon must not only be active but must also possess special physical and structural characteristics to make it effective for special purposes. There is no one type of activated carbon that can be universally effective for all purposes. Two activated carbons may contain the same percentage of active carbon, but one may be extremely valuable as a commercial vapor adsorbent, while the other, because of its low density, softness, etc., may be practically worthless for this purpose, though very valuable for decolorizing sugar solutions. Therefore the art of manufacturing activated carbon and its commercial possibilities depend as much upon the knowledge of how to control these secondary properties by proper selection of method and materials as upon the basic properties of the active carbon content itself. This fact should be kept in mind by prospective users of activated carbon.

In order that the discussion of the manufacturing processes may be clearer, let us first discuss in some detail the nature and chemistry of formation of active carbon and the structural characteristics of activated carbons.

The only theory of the nature and formation of activated carbon which satisfies the known facts is that given by Dr. N. K. Chaney.[1] According to this theory, active carbon exists as a distinctive physical modification differing from other known inactive forms of carbon by some characteristic peculiarity of molecular structure or arrangement. To this characteristic structure are attributed its special properties—namely, its unique adsorptive power for gases and vapors and, for certain substances in solution, its unusual chemical activity, and the limited temperature range of its formation. The nature of this physical or structural difference has been left to subsequent research for more complete definition. To quote the original paper: "It would be premature to assert that these two forms of carbon (active and inactive) are true allotropic modifications. It is not yet established that both forms are amorphous. . . . This much is established: The two forms are characteristically distinct and easily differentiated, both by their properties and conditions of formation." In the absence of direct evidence, the presumption

[1] *Trans. Amer. Electrochem. Soc.*, vol. 36, pp. 91-111 (1919).

of the theory has been that the active form would prove to be the simplest in structural form if not completely amorphous. Prof. Henry Briggs[2] has recently expressed the same underlying idea by referring to the active form as probably less highly "polymerized" and possessing interstices of molecular dimensions.

It has been experimentally demonstrated that the elementary carbon formed by the decomposition of carbon-containing compounds may exist in two forms—one of which is active and the other inactive. The temperature of carbon deposition appears to be the controlling factor —the carbon deposited below 500-600 deg. C. being active and that deposited above this temperature range being inactive. Carbon deposited by the catalytic decomposition of carbon monoxide by ferric oxide at 300 deg. C. is highly active. Also carbon deposited by the reaction between carbon tetrachloride and mercury[3] or sodium amalgam[4] at relatively low temperatures is active. On the other hand, the carbon deposited by cracking methane, for example, at high temperatures is inactive. It appears to be well established, therefore, that the temperature at which elementary carbon is deposited determines whether it is the active or inactive variety.

Applying this theory to the commercial preparation of activated carbon, it will be seen that the low-temperature carbonization of vegetable materials such as wood, nut shells, etc., would be expected to give a certain amount of active carbon. Why, then, does not ordinary charcoal exhibit the properties of activated carbon? The answer is that during the ordinary process of carbonization the active carbon formed adsorbs certain hydrocarbons and stabilizes them so that they are retained under conditions of temperature and pressure which would ordinarily decompose or eliminate them. This has been experimentally shown. The active carbon being already saturated cannot, therefore, exhibit any further adsorptive power. The term *primary carbon* has been applied to this complex of stabilized hydrocarbons adsorbed on an active carbon base. Ordinary vegetable chars, low-temperature carbonization cokes, blacks and coals belong to the class of primary carbons and from all these products activated carbons suitable for commercial uses can be prepared. On the other hand, cokes and other forms of carbon that are formed at high temperatures invariably consist largely of the inactive variety of carbon and cannot be activated.

Structure of Activated Carbon

The adsorptive power or "activity" of an activated carbon is determined by the amount of available active carbon that it possesses. If an ineffective activating process has been employed or if the material has not been subjected to the activating process for a sufficient length of time the proportion of the active carbon present that is rendered available will be small and its "activity" and value as an adsorbent will be correspondingly low. These slightly activated products may contain a large percentage of carbon that has not been freed from its adsorbed hydrocarbons or they may contain inactive carbon that has been formed by the cracking of hydrocarbons at elevated temperatures. Activated carbons are evaluated by methods which really measure their *available* active carbon content.

To be effective as an adsorbent the active carbon must be exposed and accessible. All highly adsorptive activated carbons are therefore either highly dispersed or are traversed by innumerable canals or capillaries whose chief function is to permit free access to the particles of active carbon. The diameter of the sub-microscopic capillaries in a highly activated coconut charcoal has been calculated from vapor pressure measurements to be of the order of 10^{-6} cm. These capillaries enable gas or vapor molecules to reach an enormous surface of active carbon—render it available. The surface thus rendered available per cubic centimeter of this carbon has been variously calculated to be from 120 to 1,000 sq.m. There are also in such a carbon many visible pores of relatively large diameter which merely act as outlet channels for the sub-microscopic pores.

When such a carbon is exposed to a high concentration of condensible vapor, a certain amount is adsorbed on the immense surface of active carbon exposed and a further amount is condensed in the capillaries of varying sizes. However, if such a carbon is exposed to a very low concentration of vapor, a considerable amount will still be adsorbed by the active carbon, but none will be condensed in the larger capillaries. This ability of activated carbon to take up vapors that are present in extremely low concentrations is one of its characteristics which distinguish it from other absorbents that are merely porous and whose adsorptive capacity under these conditions is very small.

Gas-Adsorbing Carbons—The desideratum for a gas-adsorbing carbon is that it shall have the maximum adsorptive capacity per unit of volume, rather than per unit of weight. This means that the largest *mass* of active carbon must be contained in unit space consistent with maintaining free access or passageway to all the particles in such mass. In other words, the carbon must not be too dense or its permeability is destroyed, and it must not be porous to the extent of needlessly sacrificing adsorbent material. If the density of the carbon falls below a critical minimum value, adsorptive capacity per unit of space begins to be lost. The best gas-adsorbent carbon is relatively dense. Activated coconut charcoal of maximum adsorptive capacity per unit of volume has a block density of approximately 0.66. A higher density than this indicates that the maximum surface is not exposed, and a lower density indicates that the carbon is traversed by larger pores and that the adsorptive capacity per unit volume is decreased. Aside from the proper size and number of pores is the question of mechanical strength. Carbons that are to be used for industrial gas and vapor adsorption must be mechanically strong in order to resist the crushing and abrading action to which they are usually subjected. Fortunately, the materials such as activated coconut charcoal and certain activated synthetic products which have maximum adsorptive capacity per unit volume are also mechanically strong and eminently suited to resist crushing and abrading action.

Decolorizing Carbons — Considering now activated carbons for use in adsorbing substances from liquids, we find that again the extent of the available active carbon determines the decolorizing or purifying value of the carbon. In the case of gas-adsorbing carbon, capillaries of almost molecular dimensions are desired to open up the active carbon, because the smaller the capillaries and the more numerous they are the greater the adsorptive capacity per unit volume of carbon. But in the case of adsorbing substances from liquids, in many

[2] *Proc. Roy. Soc.* (London), vol. 100A, pp. 88-102 (1921).
[3] G. Tamman, *Z. anorg. Allegem. Chem.*, vol. 115, pp. 145-58 (1921).
[4] B. Fetkenhuer, *Z. anorg. Allegem. Chem.*, vol. 117, p. 281 (1921).

instances the small capillaries which satisfactorily make available or open the active carbon for gases and vapors do not make it available for adsorbing colloidal materials or larger molecular aggregates. Presumably these small pores are plugged by such substances and so to all intents and purposes the active carbon which these pores expose is not available because it cannot be reached. The type of activated carbon that is most effective under these conditions is a highly porous material traversed by pores of relatively large size which render the active carbon available for adsorbing colloidal particles and large molecules. Such a carbon has a low apparent density and is more readily crushed than the dense gas-adsorbing type of carbon. Since this type of carbon is generally used in a finely divided form, its relative softness is not an undesirable property. Such a carbon, however, should not powder or "slime," because in this condition it cannot be readily filtered from the liquid. A finely divided "grainy" or fibrous carbon such as the carbon produced by the Chaney activation process from wood is not only a most effective adsorbent but an excellent filtering medium. While moderately bulky or low density carbons are desired, an extremely bulky carbon is undesirable, particularly in treating liquids which are to be saved, such as oils, because they entrain too much of the liquid.

It is evident that the structure of an activated carbon determines its value for a particular use. In the foregoing, the writer has pointed out some of the structural differences between the two general types of carbons. There are also many structural differences among the various types of gas-adsorbing carbons and among carbons that are intended for treating different liquids.

Processes of Manufacture

From the foregoing it is evident that in the manufacture of activated carbon a large amount of active carbon must be exposed and made available for adsorbing the desired substances. It has been shown that no one type of activated carbon can be made which can be used universally with high efficiency. It is further evident that raw materials and processes that are eminently suitable for the manufacture of highly porous finely powdered decolorizing carbons cannot be used with success for the manufacture of dense and mechanically strong granular carbons for the absorption of gases and vapors.

The raw materials available for the manufacture of activated carbon are, as previously indicated, various vegetable substances or chars prepared from these substances, coals or low-temperature cokes, and many other organic substances such as oils, gases, etc., which can be decomposed to give carbon. No matter what material is employed, it is essential that the carbon be deposited at temperatures below 600-700 deg. C. and that the adsorption of hydrocarbons by the active carbon be prevented or that the adsorbed hydrocarbons be eliminated in such a manner as to leave the active carbon base free. As has been explained, it is also essential that the activated carbon material have the proper physical characteristics. This is determined by the proper selection of raw materials and activating processes.

To prepare a material containing a high percentage of active carbon is a very difficult matter and it must be understood that not all processes in use are equally effective. Most of the older processes that have been suggested are for preparing decolorizing carbons from specially selected raw materials. These decolorizing carbons are classed as activated carbons, but many of them contain a relatively small percentage of active carbon and cannot compare in adsorptive power with the highly activated carbons now produced. Practically none of the processes or raw materials available for preparing highly porous pulverulent decolorizing carbons can be used to prepare highly active granular gas-adsorbing carbons. The processes by which various types of activated carbon can be made may be classified as follows:

(1) Processes depending on the action of inorganic chemical compounds either naturally present or added to prevent the formation of the adsorption complex during carbonization or to cause the breaking down and elimination of the adsorbed hydrocarbons during the succeeding calcination.

(2) Processes depending on solvents to eliminate the hydrocarbons.

(3) Processes depending solely on long-continued calcination to eliminate the hydrocarbons.

(4) Processes depending on selective oxidation to break down and remove the adsorbed hydrocarbons and to alter the porosity of the carbon.

Activation Processes Depending Upon the Action of Chemicals Naturally Present or Added to Raw Materials—By far the greater number of processes for producing decolorizing carbons that have been disclosed or patented belong in this group.[5] The raw materials employed in these processes are practically all of such a character as to give soft, highly porous products which contain some active carbon. The carbons produced by these processes have value for decolorizing liquids because of their very great dispersion, but because of their usual low content of active carbon and physical characteristics they are practically worthless for adsorbing gases and vapors.

In certain cases a raw material such as kelp[6] and rice hulls[7] contains a sufficient amount of the proper sort of substances to enable a decolorizing carbon of value to be prepared from it by a simple carbonization, calcination at high temperatures and subsequent purification.

In most cases, however, the raw material is admixed or impregnated with various chemicals. The disclosures in journal and patent literature show that the number of compounds that may be used more or less successfully in producing decolorizing carbons is large. The following may be mentioned: Alkali hydroxides, carbonates and sulphates; alkaline earth oxides, carbonates, chlorides, sulphates, phosphates and acetates; zinc chloride; manganese oxides; and phosphoric and sulphuric acids. Various proportions and mixtures of these chemicals are employed and to be most effective they must be mixed with the vegetable materials prior to their carbonization. The final calcination is in general carried out at temperatures around 900 deg. C. The residual chemicals must be removed before the carbon can be used, and in those cases where acid is required the extraction is costly. As a rule the raw materials are used in a finely divided form, so the final products appear in the form of a powder.

Activation Processes Depending on the Action of Solvents—Since the formulation of the activation theory previously discussed, suggestions have been made from

[5]F. W. Zerban, et al., Bulletin 167 (May, 1919), Agricultural Exp. Station of the Louisiana State University and A. & M. College.

[6]J. W. Turrentine et al., *J. Ind. Eng. Chem.*, vol. 14, No. 1, p. 19 (1922).

[7]W. G. Taggert, *La Planter*, vol. 58, p. 581.

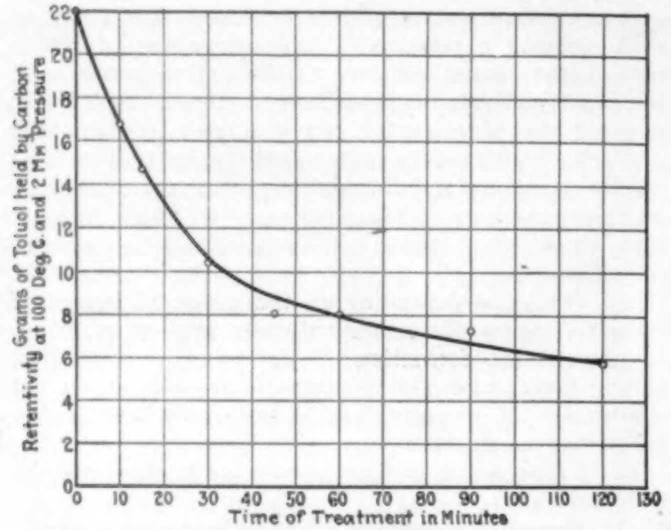


FIG. 1—DEACTIVATION OF ACTIVATED CARBON BY "GAS TREATING"

Natural gas passed over activated coconut charcoal held at 1,000 deg. C. Retentivity for toluol taken as measure of activity.

time to time that the hydrocarbons with which the active carbon base of primary carbons is saturated be removed by suitable solvents. All the various well-known solvents for resins, tars and pitches have been suggested. The use of selenium oxychloride for this purpose has been patented.[1] Even assuming that all the objectionable hydrocarbons are soluble in the special solvent, the trouble with these schemes is that no provision is made for removing the solvent which is readily adsorbed or for controlling the porosity of the carbon, both of which steps are necessary before the carbon can have any special value as an adsorbent.

Activation Processes Depending on Long-Continued Calcination at Elevated Temperatures—It is claimed that certain carbonization products or primary carbon materials may be partly activated by long-continued heating in a neutral atmosphere at temperatures around 850 deg. C. Our experience and the experience of others indicate that any activation obtained by such treatment is fortuitous in that it is largely due to the oxidizing action of air[2] originally held in the pores of the primary carbon or which enters the apparatus during the calcination. Activation by heat-treatment alone cannot be successfully accomplished because the hydrocarbons present are cracked at the high temperatures employed and inactive carbon is deposited upon the active carbon base. The resulting product has little or no activity. That active carbon is actually deactivated by a very slight deposition of inactive carbon upon it by the cracking of such a hydrocarbon as methane at 1,000 deg. C. is shown by the curve in Fig. 1. The activity of the carbon, which is measured by the amount of toluol held at 100 deg. C. and 2 mm. pressure, decreases as the amount of inactive carbon deposited increases and is practically nil when less than 1 per cent of inactive carbon has been deposited. This deposition of inactive carbon by the cracking of contained hydrocarbons when a primary carbon is calcined at high temperature is the fundamental reason, therefore, why the manufacture of a highly active carbon is a difficult matter.

Activation Processes Involving Selective Oxidation—Processes in which a selective oxidation is employed to render available active carbon initially present in the material treated are far superior to any other as yet developed for the preparation of highly activated carbons possessing particular structural characteristics. It is only by the use of such processes that it is possible, at the present time, to manufacture in quantity a carbon which meets the requirements of a commercial gas and vapor adsorbent.

It was this method of activation that was employed exclusively by the U. S. Chemical Warfare Service during the war and which made it possible for the Service to supply, in enormous quantities, a gas mask carbon which far surpassed in efficiency any that was available elsewhere. The process was developed under the stress of urgent war-time necessity by Dr. Chaney and those under his direction—an accomplishment all the more notable when it is considered that the United States was the last of the warring nations to be confronted with the necessity of an effective gas mask carbon.

Incidentally, the difference in the requirements of a carbon for decolorizing purposes and of one for gas adsorption is made strikingly apparent by consideration of the facts that while decolorizing carbons of fair quality had been made and sold before the war, these carbons were practically useless for gas masks, and the scientists of the other warring nations had been unable to produce modifications of them which were comparable in efficiency for gas mask use with the product of the Chaney process.

Fundamentals of Chaney Process

Dr. Chaney's contribution consisted essentially in an apprehension of the following fundamentals:

(1) Certain varieties of carbon are inherently inactive, and selective oxidation can be effective in causing activation only when applied to materials sufficiently free from the less easily oxidizable inactive carbon.

(2) A material amenable to activation by selective oxidation and free from inactive carbon can be prepared only if the carbon is liberated below certain critical temperature limits.

(3) A material containing active carbon is ordinarily useless as an adsorbent until this active carbon is freed from the hydrocarbons saturating it, and maximum adsorbing efficiency can be attained only when the maximum proportion of the active carbon present has been rendered available.

The principles enunciated by Chaney, and the process which he based on them, are the foundation on which has been built the National Carbon Co.'s output of activated carbon.

Despite the limitations imposed by the first principle, it was early demonstrated that the raw materials in which a sufficient amount of active carbon, sufficiently free from inactive carbon, was present or could be produced were more numerous than the materials that theretofore had been regarded as promising sources of gas-adsorbent carbon. It has further been found possible to produce superior decolorizing carbons from a variety of raw materials by employing the selective and limited oxidation processes which enable the dispersion or porosity of the activated product to be controlled. In fact all types of primary carbons may be activated by this general process to give many new and different types of activated carbons suitable for different purposes.

The primary carbons as defined by Chaney include all chars, cokes and carbon materials formed at low temperatures—below 600-700 deg. C. Vegetable chars, carbon blacks, lampblacks, low-temperature cokes and coals containing a small amount of volatile matter come under this definition. Some of these materials may be heated to temperatures above 700 deg. C. without be-

[1]V. Lehner and F. M. Dorsey, U. S. Pat. 1,423,231 (1922).
[2]Philips et al., *J. C. S. Trans.*, vols. 117-118, pp. 362-699 (1920).

coming seriously contaminated by inactive carbon deposition as a result of "gas-treating." Other materials will become self-gas-treated if heated at a high temperature and then cannot be activated because selective oxidation will destroy the active carbon rather than the inactive carbon thus deposited.

When a gaseous oxidizing agent is employed, such gases as air, carbon dioxide and steam may be used. The process employing air as the activating agent has the advantage of relatively low-temperature operation—around 350 deg. C.—but the rise in oxidation potential with temperature is very rapid and the process is extremely difficult to control. As previously explained a *selective oxidation* of the residual hydrocarbons is desired. The oxidation by air, however, has been shown to be less highly selective and consequently, while a considerable amount of carbon is oxidized, the remaining carbon is only moderately activated. While the highest quality active carbon has not been produced by air activation process, an appreciable percentage of the carbon made by the U. S. Chemical Warfare Service for gas masks during the war was so activated.

Processes employing carbon dioxide or steam have the disadvantage of high-temperature operation—around 900 deg. C.—but these reagents exercise a selective oxidizing effect and the reaction, being endothermic, is readily controlled. Flue gas containing carbon dioxide has been used to produce some fairly well activated carbon, but after a very extended investigation it has been concluded that more highly activated carbon can be produced by steam activation. It appears also that the removal of the hydrocarbons with a minimum of "cracking" and consequent deposition of inactive carbon can be accomplished only when the concentration of the oxidizing agent is high. This means that the steam, for instance, must be introduced in excess and that the reaction products must be effectively led away. The operating difficulties are further increased by the fact that all primary carbon materials are very poor conductors of heat.

Variations in Properties

The great advantage of the Chaney process is that by employing proper steam rates for different periods, at selected temperatures, the characteristics of the activated product may be widely varied within limits depending upon the character of the primary carbon employed. This may be strikingly shown by data concerning the relative variations in properties of coconut charcoal activated under one set of conditions for various lengths of time. These data are presented graphically in Fig. 2. The variations in sorptive characteristics are shown by the curves marked "saturation" and "retentivity." To obtain the saturation value the carbon is dried, evacuated and then saturated with the vapor. This value, therefore, is a measure of the total sorptive capacity of the carbon when the vapor is held both by capillary condensation and intermolecular forces. When the saturated carbon is heated at 100 deg. C. while the pressure is reduced to 2 mm., the vapor condensed in the capillaries is largely removed and only the vapor is retained that is strongly held by the specific adsorptive power of the exposed active carbon. The weight of the vapor retained gives the "retentivity" or specific adsorptive capacity value. This value, therefore, is proportional to the active carbon exposed.

The curves show that the activation process proceeds

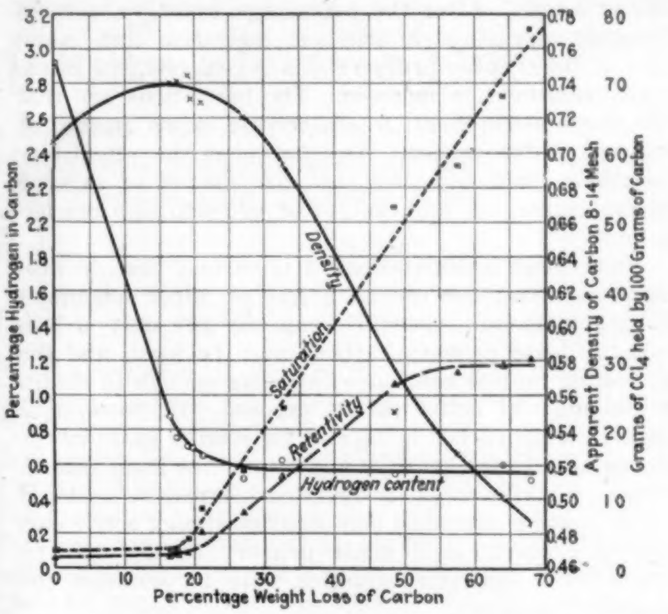


FIG. 2—VARIATIONS IN PROPERTIES OF COCONUT CHARCOALS ACTIVATED FOR VARIOUS LENGTHS OF TIME

Activation temperature, 1,000 deg. C. Weight of charge, 20 grams.

in two distinct stages—viz., a stage in which the percentage hydrogen content is being rapidly reduced and a stage in which the percentage hydrogen content is being reduced very little or not at all. Approximately 20 per cent of the charcoal is gasified during the first stage. The material removed has an average percentage hydrogen content of 11.6 and is quite evidently hydrocarbons. Until the bulk of these hydrocarbons are removed the material has no appreciable saturation or retentivity value.

As the activation proceeds into the second stage, however, the material removed by selective oxidation has an average percentage hydrogen content of 0.78 and must, therefore, comprise a comparatively very large proportion of uncombined carbon and a comparatively small proportion of hydrocarbon. The fact that the percentage of residual hydrogen ultimately becomes approximately constant probably indicates that some of the hydrogen is disseminated through the active carbon base in such a fashion that it is not accessible to the oxidizing agent, as would be expected in dealing with particles of considerable size, in this particular case 8 to 14 mesh. During this stage both the saturation and retentivity increase, the saturation increasing at an approximately constant rate to the limit to which the tests were carried and the retentivity increasing at a diminishing rate to a maximum when about 60 per cent of the charcoal has been oxidized. The apparent density decreases at an approximately constant rate during this stage.

The saturation values in conjunction with the other values show that when the bulk of the hydrocarbons had been removed and the active carbon base was laid bare the capillary spaces began to increase at an approximately constant rate as the carbon was eroded by oxidation. Certain conclusions may also be arrived at from a consideration of the retentivity values in conjunction with percentage hydrogen content. The fact that the retentivity begins to increase while the percentage hydrogen content is still decreasing probably indicates that the layer of adsorbed hydrocarbons is not of uniform thickness, or not uniformly accessible to the oxi-

dizing agent. After the percentage hydrogen content becomes approximately constant, indicating that oxidation of the exposed hydrocarbons is complete, the retentivity continues to increase. The indications are that the phenomenon is due to an increase in the amount of exposed active carbon. The fact that the retentivity reaches a limit indicates that the amount of exposed active carbon per unit weight of material also reaches a limit.

From these considerations it is obvious that, to produce a carbon for use as a gas or vapor adsorbent having maximum adsorptive capacity per unit of volume, a dense primary carbon must be used, and the activation process continued only long enough to obtain a maximum of active carbon exposed. If, however, a highly porous carbon is desired for storing gases or for removing coloring matters and impurities from certain liquids, a highly porous primary carbon may be used and the activation continued only until maximum active carbon is exposed, or a dense primary carbon may be subjected to selective oxidation until it possesses the necessary porosity.

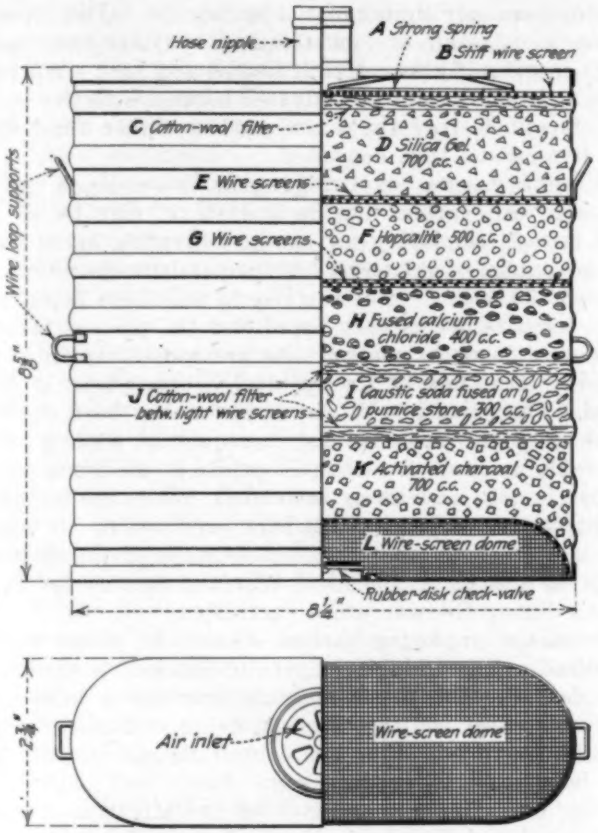
In the foregoing paper the numerous activating processes, most of which are for the manufacture of decolorizing carbons, have been considered. It is pointed out that the Chaney selective oxidation process appears to be the only one by which the new highly active and most efficient gas- and vapor-absorbing carbon can be produced. It is also shown that because this process gives maximum activity and allows the secondary properties, such as porosity, to be altered at will, it can be employed in the manufacture of decolorizing carbons of high efficiency. In fact, by activating suitable raw materials through some modification of the Chaney process carbons can be prepared that have the desired characteristics for any application.

Universal Gas Mask

Many Possible Uses for New Tpye of Mask Developed by Bureau of Mines

To fill the need felt for masks of general utility in the chemical, metallurgical and related industries, the Bureau of Mines has developed a new Universal mask. A special type of the same mask has been developed for use by firemen. Although special masks have been developed previously for use against specific gases, such as carbon monoxide or ammonia, this is the first efficient mask to be developed which may be used in either of these as well as in many other contaminating atmospheres. To combine efficiency in one canister the absorbents for all noxious gases is difficult, because the absorbents for certain gases are best used moist, while the absorbents for carbon monoxide may be used only when perfectly dry.

As shown in the cut, the following chemicals are used in the mask: *D*—Silica gel to remove ammonia and any other organic vapors which escape the charcoal at the bottom of the mask, also to guard against moisture reaching the hopcalite from above. *F*—Hopcalite to remove the carbon monoxide from the dry gas. *H*—Calcium chloride to remove any particles that may pass the caustic pumice. *I*—Caustic soda, on granules of pumice stone, to absorb acid gases such as carbon dioxide, chlorine, formic acid, hydrogen cyanide, muriatic acid gas, oxides of nitrogen and sulphur dioxide, and gases of similar chemical properties, also to extract



CROSS-SECTION SHOWING CHEMICALS IN MASK

water vapors from the air, thus preventing the moisture from contaminating and inhibiting the hopcalite. *J*—Filter of cotton wool, about ¼-in. thick, between two light wire screens, to filter out the supensoids, including smoke, mist and dust. *K*—Charcoal, used to absorb organic vapors, including alcohol, aniline, benzene, ether, carbon bisulphide, carbon tetrachloride, toluene, etc.

In those industries in which a workman requires protection against only a single gas or class of gases, it would be cheaper to use a single absorbing medium in the canister. However, in many industries workmen may encounter a variety of gases and city firemen may meet almost any sort of gas or vapor. Men using the Universal type of mask can face these conditions and do work that they could not possibly do otherwise. Tests conducted on a wide variety of gases show that the probable life of a mask is considerably in excess of 6 hours, but, due to the fact that carbon monoxide may go through unabsorbed after this period and since this gas is not detected readily because it is odorless, this arbitrary time limit has been placed on the use of the mask.

Among the ordinary gases in which the mask is not efficient in protecting the wearer is methane. It cannot be used in atmospheres deficient in oxygen, as in the flues of industrial plants, mines and closed rooms after fires and explosions. It is also dangerous to use the mask in atmospheres containing higher concentrations of gases, as in chemical and metallurgical apparatus tanks containing gasoline or other volatile liquids or in inadequately ventilated rooms in which large quantities of gas are evolved. In general the mask should not be used in toxic gases having a concentration of more than 1 or 2 per cent. The canisters are more active when warm, so in cool or cold weather should be worn under a coat to receive the body heat.

Current Practice of Making Electric Steel

Best Practice Still Undecided on Many Features—Are Acid Furnaces Best for Low-Sulphur Charges?—Basic Will Eliminate More Sulphur, but Pure Raw Materials and Expert Refiners Are Necessary for Superfine Steel

BY BRADLEY STOUGHTON
Consulting Engineer

THE electric steel industry is not yet standardized: First, because progress is so rapid that it keeps ahead of the dissemination of information, which those who are doing the best work are not always willing to give out. Differences of opinion, due to lack of full knowledge, therefore, persist. A second cause is due to the fact that all recent improvements are not open to general use without royalty, and that conflicting claims are not always free from selfish interest. This is always the situation where an industry is so new that patents control some of the desirable features.

TYPES OF FURNACES

It would be impossible to give a description of all the recent furnaces now in use, but Table I classifies the types in accordance with the chief features, which vary largely in respect to: (*a*) Methods of heating the charge; and (*b*) methods of making electrical connection.

Method of Heating Charge.—It is obvious that electrical efficiency and endurance of the linings are both greatly enhanced when the charge is heated by virtue of its direct resistance to the passage of the current. Nevertheless the difficulties of accomplishing this, consisting chiefly of the difficulty of making the electrical connection and the inconvenient form of bath, have hampered the employment of this method of heating. From the metallurgical standpoint many advantages are obtained through the excellent stirring action caused by Dr. Carl Hering's "pinch effect," so extensively used in non-ferrous work. Therefore steel men earnestly desire a type of bath which can take advantage of this "pinch effect" and also be of convenient form. At the same time some means must be had of readily producing the carbide reaction $CaO + 3C = CaC_2 + CO$ without the use of an arc, since the carbide is so valuable both for desulphurizing and deoxidizing.

The direct arc from the electrodes to the metal or slag has proved more efficient economically and metallurgically than the indirect arc of the Stassano.

Method of Making Electrical Connection. — The method of introducing the current is the greatest present weakness of the electric furnace. The induction principle is ideal from the standpoint of current connection, but involves low electrical efficiency, serious lining difficulties, and inconvenient shape of bath. For these reasons it is less used. But the electrode principle is costly in design and operation, and metallurgically it introduces the complication of carbon in contact with the bath, which limits the field of application. I look to this feature (electrical connection) as the one most in need of improvement by invention of a radical character, such as the "ironless induction" principle, which, however, seems applicable only to furnaces of laboratory size.

The evidence is still conflicting as to the relative merit of passing the electricity through the hearth of the furnace. Undoubtedly it has many advantages over the exclusive use of suspended electrodes above the bath, and interesting claims are made about the operation of the new Italian Fiat furnace. But hearth troubles are serious enough without having electrodes imbedded in them, and the first prejudice is certainly against complicating this part of the furnace in any way. Nevertheless furnaces having electrodes buried in the hearth are being worked with great success where care and skill is exercised. Many persons have found less difficulty in power fluctuations when melting a cold charge on a conducting hearth.

Graphite vs. Carbon Electrodes.—The size of electrodes appropriate to the different sizes of furnace is now fairly well established, and the information is public. Graphite electrodes cost about twice as much as carbon electrodes per pound, but have greater conductivity per unit of area. The carbon electrodes have the further advantage that they may be made right at the furnace plant if desired. They are also slightly stronger, and their greater area increases the arcing surface. Their lower heat conductivity decreases the radiation loss through the electrodes, but increases the radiation loss through the roof on account of the larger hole necessary; this also weakens the roof. They are also more difficult to cool in the electrode holder and require a costly thread and nipple joint. Carbon electrodes oxidize more easily in the furnace and require heavier control mechanism. Their broken stumps are harder to remove from the bath.

It is still a good commercial operation where steel scrap and electricity are both very cheap and cast iron

TABLE I—CLASSIFICATION OF ELECTRIC MELTING AND REFINING FURNACES

Method of Making Electrical Connection.		Method of Heating Charge	Name of Furnace
	Method of Getting Electricity Into Furnace		
Hearth is Not Supposed to Carry Electricity	Induction Principle	Direct Resistance	Kjellin Roechling-Rodenhauser
	Carbon or Graphite Electrodes	Indirect Arc	Stassano Rennerfelt
		Direct Arc to Metal or Slag From Electrodes	Heroult vom Baur Ludlum Volta
Hearth Serves as a Conductor of Electricity			Snyder Greaves-Etchells Girod Fiat Grönwall Booth Stobie Nathusius Moore Greene

is scarce and costly, to melt steel scrap to a temperature of 1,400 deg. C. or higher, carburize it until it contains $3\frac{1}{2}$ to 4 per cent carbon, and then give it the desired composition in silicon by means of appropriate alloys, especially where the metal from the electric furnace may be cast directly into molds. During the war there were many plants engaged in this process, making "synthetic cast iron" in France, Canada, United States and Germany. Most of these died with the change of commercial conditions consequent on the ending of the war, but there are still isolated localities where iron castings may be made in this way cheaper and better than by any other known method. A notable example is an iron foundry connected with a large gold mine in Alaska, where both fuel and cast iron are costly but where there is a supply of steel scrap. There are many mining localities in South America where the saving effected by a quick repair would exceed many times the cost and overhead of a synthetic cast iron foundry.

There were two methods of making synthetic cast iron—namely, straight melting in the electric furnace, and melting in a cupola followed by superheating in an electric furnace.

Order of Excellence in Steels

There is now a general agreement among engineers that the quality of carefully made steel by the different older processes is in the following order of excellence: First, crucible; second, acid open hearth; third, basic open hearth; fourth, acid bessemer; fifth, basic bessemer. Whether electric steel is equal to or subordinate in quality to crucible is still a controversial point.

The presence or absence of "sonims" (solid nonmetallic impurities) is the final test as to the supreme quality of steel, because all other impurities are controlled without great difficulty. The relative excellence of crucible or electric steel therefore comes to this: We know that well-made crucible steel is free from sonims; electric steel is not always so certain, although it should be, and almost always is, free from these impurities when well made. In the matter of large ingots the electric furnace has the advantage of making the steel in big units and doubtless gives a greater assurance of uniformity than when many crucibles have to be poured into one ingot mold. At the present moment conservatism and carelessness on the part of some electric furnace operators leave the advocate of the crucible furnace in the stronger position of the two.

From the standpoint of excellence—that is, very low content in phosphorus, sulphur, sonims and gases—the basic-lined electric furnace has the better of the argument with the acid electric. But, from the standpoint of "superexcellence"—that is, absolute freedom from gases and sonims—the acid process has these points in its favor: (*a*) Pure raw materials must be employed, and pure raw materials are essential for the production of "superexcellent" steel in any type of electric furnace; (*b*) the slag also is purer; (*c*) recarburizing in the acid furnace is less likely to produce sonims than in the basic furnace.

On the other hand, the acid slag is subject to great viscosity, which introduces a serious danger of sonims, while the basic slag is the better degasifier of the two. Skill and care in operating are doubtless much more potent factors for superexcellence than either set of advantages mentioned. For example, merely to pour electric steel out of the furnace introduces far more sonims than any factor mentioned so far. Indeed, it seems fair to declare that "superexcellent steel" cannot be made unless the metal is tapped from a quiet bath without slag being carried with it.

Super-Refining Liquid Steel

The cheapest method of making steel of very high quality is to put liquid steel in an electric furnace and then super-refine it. Since the super-refining is chiefly for the purpose of eliminating sonims and gases, and since the electric furnace is not adapted to much refining in one step, the acid electric furnace might be used. It has the advantage of affording a quicker and cheaper operation, but the acid slags are very sticky and they will not hold calcium carbide, which is the most effective agent for desulphurizing and degasifying a steel bath. True, the acid process can remove a little sulphur by the judicious use of manganese, but the amount is limited and is usually less than must be eliminated from liquid steel coming from other furnaces. For instance: the upper limit of sulphur in molten steel introduced in even the basic electric furnace is now 0.08 per cent and this sometimes requires two carbide slags before it is reduced to 0.03 per cent, which is the maximum sulphur expected in an electric furnace product. Super-refining is the ideal function of the electric furnace; when we try to accomplish the ordinary operations of refining or even attempt too big a step in super-refining the result is excessive cost and poorer quality. The lesson of recent electric furnace experience is that we can add only the top notch of excellence; if we start with too low purity of raw material, the highest quality is never attained.

One of the worst problems in super-refining practice still remains to be overcome. I refer to the chilling of the liquid metal when poured into the furnace. Following the preceding heat the roof and lining must be examined and repaired carefully to avoid costly troubles from these sources. As an average figure it will perhaps take 500 lb. of dolomite to repair a 25-ton furnace lining, although this figure will vary greatly from operation to operation and plant to plant. This repair work takes time and cools the furnace. The metal from the basic open hearth also cools in transit. Furthermore its melting point is relatively high, because it must be 10 to 25 points lower in carbon than the desired final analysis of the super-refined product, to allow for carbon picked up from the carbide slag. The arc furnace is not a good instrument to handle a bath of metal frozen on its surface and especially along the sides, where it is furthest removed from the source of heat. Here again some means of keeping the bath stirred would be of great commercial advantage. Twenty to forty minutes on power are usually required to recover the lost heat.

Another serious difficulty is to estimate exactly the weight of metal charged to the furnace. This information is important in order to determine the weight of additions for "recarburizing." When nickel steel is being made the established practice is to add a known amount of nickel to the bath as soon as charged. As soon as this is all melted the analysis of the bath, compared with its composition before the nickel was added, gives a close means of estimating its weight.

Recent electric furnace practice retains at least 0.20 per cent manganese in the bath throughout the operation. This decreases the burden of the slag while deoxidizing the bath and reduces the final manganese addition, with its concomitant danger of sonims. It is

usual for the charge of liquid metal to contain 0.30 to 0.40 per cent of manganese and less than 0.02 per cent phosphorus. The slag is added while the metal is being poured into the furnace; it will be about 2 per cent of the weight of the metal and will be rendered very fluid by both fluorspar and silica, in nearly equal proportions. As much silica will be used as will give 20 parts of silica to 70 of lime in the final slag. Coke is not added until slag and metal are well melted. The weight of coke is about 10 per cent of the weight of slag, but more is added if necessary to keep a strong carbide slag, smelling strongly of acetylene when dipped in water. At the end of the operation the slag should contain at least 0.4 per cent of CaC_2; 1 per cent is better.

Stirring the Bath

Various expedients have been tried for stirring or circulating the bath, with the especial object of bringing the cooler metal from the bottom up nearer the source of heat and of bringing each particle of steel into contact with slag that will rid it of oxides, gases and sonims. The two measures so helpful in the open-hearth furnace—mechanical stirring and "pigging up"—are objectionable, because the doors of an electric furnace must be kept closed and even luted as tight as possible to keep oxygen out of the furnace atmosphere and to keep the temperature uniform. Furthermore, "pigging up" is impossible with a deoxidized bath and slag. If carbon is added in this way, it requires lower carbon steel and therefore greater chilling difficulties with the initial charge.

The temperature adjustments of the bath require the utmost care and expertness. Some large operators have considered means of automatic temperature control to prevent heating the bath more than 250 deg. C. above its melting point during the last hour. This is the constant tendency of furnace men eager to finish with a fluid metal and slag, but a tapping temperature more than 200 to 250 deg. C. above the melting point lowers the quality of the product. On the other hand, it should not be less than about 200 deg. above the freezing point, because the steel should lie in the ladle for 30 minutes or so, to allow to float to the surface solid particles which may have been stirred into the metal during tapping. Low temperature during the final hour of the process also interferes with the gravity separation or liquation of sonims so minute that, unless they are fluid enough to coalesce easily and are suspended in a non-viscous bath, they will not rise to the slag in the time available. A certain amount of such sonims is inevitably formed by the oxidation of elements during "recarburizing."

All elements such as nickel, which are not oxidized, should be added at the time of charging, in order to avoid chilling the bath during the final stage. The addition of other "recarburizers" should be completed at least 45 minutes before the end of the operation, and should be made in small doses to avoid chilling. The order of charging should be: first, ferrosilicon, then ferromanganese, ferrochromium (if any), and ferrovanadium last. The two reasons for this sequence are important: (1) It follows the reverse order of intensity of deoxidizing power, and (2) offers the best possibilities for sonims to coalesce. In case aluminum is used it should follow the silicon, and then ferrotitanium should follow the ferromanganese. Many operators add ferrosilicon after all but the ferrovanadium, because of its possible effect on the basic slag, but this undoubtedly introduces an added danger from the standpoint of superexcellence of the product. An alloy of calcium and silicon has been used, with the double object of forming readily coalescing oxides and effecting some desulphurization. This has never become general practice. It is understood that this alloy was added immediately after the bath and slag were deoxidized. The practice of adding ferrosilicon at this point is common at some plants, but is feared at others, because it involves carrying "residual silicon" in the presence of "residual manganese" and a basic slag. It also involves the operation of getting the ferrosilicon dissolved in the metal before it comes in contact with the slag. The presence of calcium in the calcium-silicon alloy affords a certain protection against the latter danger and increases the amount of lime present.

To super-refine liquid steel takes 4 to 5 hours, including repairs to lining and charging, and a power consumption of 100 to 200 kw.-hr. per ton of product.

Melting and Refining Steel Scrap

There are two distinct ways to melt and refine scrap. When impure scrap is melted an oxidizing period must be included during and (sometimes) after melting. Sometimes this requires two oxidizing slags. In any event, the bath is oxygenated and its final quality is never as good. Even those who declare that the electric furnace can remove every trace of oxygen admit that the operation is long and costly.

The other way is to melt only a pure charge—that is, one with less than 0.02 per cent phosphorus and 0.08 per cent sulphur. Such a bath needs no oxidizing period, and the quality of the product is equal to the best super-refined liquid steel. The absence of an oxidizing period also enables the maker to use alloy steel scrap—that is, scrap from the manufacture of high-speed steel, chromium or chromium-vanadium steel. A regular market now exists for such scrap, through which the steel maker can get his tungsten, manganese, chromium or other alloying element cheaper than it is available in a ferro.

Pure Scrap. These considerations of quality and cheap alloying elements have led to the adoption of the pure scrap process for tool steels and most high-grade special alloy steels. The operation is divided into two steps: first, melt and second, super-refine. It does not differ in principle from the super-refining described above. In melting, the direct-resistance furnace, properly operated, has an advantage over the arc type, on account of the expert labor required by the latter and the irregularity of the power input. In this latter respect two recent improvements are of outstanding importance—viz., the automatic regulator of J. A. Seede and the peak load regulator of E. T. Moore. It is also claimed that the conducting hearth decreases the "jumping" of the arc during melting. The validity of this claim is not yet established, but the plurality of melting and refining furnaces are of the arc, hearth-conducting type. A higher voltage is used during melting than in the super-refining stage. Lime for slag-making purposes is put on the hearth previous to charging; this is thinned with 25 per cent or so of fluorspar or with silica, or both, as soon as a pool of metal is formed. The slag must always contain more than 55 per cent of lime and be very reducing. The latter feature is even more important than when super-refining liquid steel, since it is now important not to oxidize any of

the costly metalloids. From ½ to 3 per cent of carbide should be maintained in the slag. As soon as a pool is formed, coke is shoveled into the furnace, and more is used when necessary. Greater precautions are observed in keeping the doors closed and luted than in super-refining liquid steel, and it is usual to scatter coke dust over the top of the slag whenever the door is opened. While the addition of coke to the slag will reduce manganese or chromium back into the metal, in case any has been oxidized, it requires both coke and high temperature to reduce tungsten.

There is this important difference between the two types of super-refining: That the carbon in the steel produced from liquid charges is usually lower than that in tool steel made by melting scrap. Therefore coke may be more freely used in the latter. Also it is much commoner and safer to add silicon in small doses in early stages of the practice we are now discussing, especially when tungsten is present, because tungsten serves as a warning preceding slag difficulties that might arise from oxidation of silicon. Silicon in the bath during super-refining assists degasification and makes the steel sounder and denser. The amount of slag is greater in this type of super-refining, and varies from 3 to 7 per cent of the weight of the metal. Its composition is about the same, except for higher carbide. It should not exceed 18 to 20 per cent silica, and some operators prefer to use chiefly fluorspar for thinning, in order to increase the excess of lime present. Then, however, volatile fluorine compounds increase the corrosion of walls and roof.

In the basic electric furnace a good operator can melt and super-refine pure scrap in 4½ to 6 hours, with a power consumption of 600 to 800 kw.-hr. per ton of product. The main reason for the excess power consumption over liquid-steel super-refining is that great power irregularities occur during melting. Furthermore, smaller sized furnaces are ordinarily used, together with a larger slag volume.

Acid Versus Basic

In melting pure stock in the electric furnace the basic process loses its chief commercial advantage—viz., low cost of raw material. In every other respect—labor, time, electric power, overhead, repairs, lining, fluxes and recarburizers—the acid process is cheaper. The acid furnace is handicapped in removing sulphur, but a liberal use of manganese will bring it down quite a little, and the difference in cost is not great between 0.04 or 0.08 per cent sulphur scrap pure in other respects. It is now customary to use one acid slag for more than one operation, because impurities do not accumulate in it. No ferrosilicon is added, because silicon is reduced from the slag. This saves cost and the danger of silicon sonims. Acid steel is less oxidized and less gasified than basic steel after melting, so less manganese is used. The sticky acid slag is more easily entangled than are basic slag particles, but the more subtle danger of silicon or manganese sonims is greatly reduced. Finally, the engineers' prejudice in favor of acid steel helps sell the product in competition. The acid furnace has the disadvantage that it cannot be used on occasion for purifying impure scrap unavoidably accumulated or available under advantageous conditions.

Melting and Refining Impure Scrap

As ordinarily conducted this process is cheaper than melting and super-refining pure scrap, but gives a product of lower grade. Of course, only basic furnaces can be used. Even then the phosphorus must be under 0.09 per cent or the oxidizing period will be extended beyond the point of economy. Limestone, instead of lime, is spread on the hearth. Sometimes pig iron is used to make the bath melt down hard or to increase the yield by using more ore; if so, the pig is placed on top of the limestone. On top of this is placed enough iron ore to oxidize the silicon and phosphorus, and these should be gone by the time the "lime comes up." The temperature of the bath should never reach the point where manganese or carbon are oxidized instead of phosphorus. Good modern practice produces a melted bath with residual manganese, carbon 10 to 25 points less than the desired final analysis, phosphorus less than 0.02 per cent. Some prefer to melt down soft and, when the white slag is melted, add carbon in the form of pig iron, washed metal, coke, charcoal or ground electrode stumps. This stirs the bath, removes dissolved oxygen and increases the yield slightly. It is both difficult and dangerous to make low-carbon steel by this process, because some carbon is always added from the carbide slag, and if you melt down very soft it oxygenates the bath severely. In case a second black slag must be used it is evidence of bad practice or too impure raw charge. Every pound of black slag must be removed before the white slag is charged.

The white slag is mixed outside the furnace, of lime, fluorspar, silica, and coke. It contains more than 55 per cent lime and one shovel of coke to three of lime. After it is charged the analysis is adjusted carefully, the temperature being raised as rapidly as possible meanwhile. If carbon is added, it goes in first, then enough ferrosilicon to give 0.10 to 0.20 per cent of silicon in the metal, which is maintained to the end. Next comes ferromanganese, if necessary. Some operators prefer to melt down with only a small residual manganese, in order to add ferromanganese after ferrosilicon, with the object of removing silicon sonims. Others add ferromanganese after the deoxidizing slag has become white, thus saving some manganese. All additions made after the white slag should be in small doses. The more oxidizable elements, such as tungsten and vanadium, should never be added until the slag is entirely white. When this point is reached the real super-refining begins; more coke and lime are added to the slag and a carbide slag with at least 1 to 3 per cent of CaC_2 content is maintained to the end. The operation is practically the same as that already described.

The total time of melting, refining and super-refining occupies from 4½ to 7 hours, depending on the degree of purification and the skill of the operator.

Aluminum Production

The value of the new aluminum produced in the United States during 1922 is reported as $13,622,000, an increase of about 25 per cent over the value in 1921. Exports of aluminum during 1922 included 1,538,079 lb. of ingot and scrap aluminum and alloys containing aluminum, 2,808,946 lb. of plates, sheets, bars, strips and rods, and 4,548,939 lb. of manufactured articles, which represents a very large increase over the amount exported during the previous year. Imports, on the other hand, also increased to 31,482,983 lb. during the early part of 1922, as compared to 26,177,852 lb. for the corresponding period in 1921. This amount includes aluminum in crude form, scrap and alloys of any kind in which aluminum is the material of chief value.

Meeting of the Iron and Steel Institute

Committee Reports Against 12-Hour Day—Papers on Chemistry in the Iron and Steel Industry, Gas Producer Operation and Firebrick Disintegration

AFTER a year's consideration, a committee composed of the chairmen of the large steel companies has presented a preliminary report on the 12-hour day. Judge Gary read its findings at the opening of the Iron and Steel Institute in New York, May 25.

The report stated that the problem was taken up because of the widespread impression that long hours in the steel industry were undesirable and injurious. Despite the opinion held by the committee that this sentiment was kept alive not by the workmen themselves but by outsiders, a careful investigation was made. In the light of the information obtained the committee reports that the 12-hour shift is not injurious to the worker, physically, mentally or morally—in fact, it believes that the managers of important plants generally have the workers' welfare so much at heart that such influences would be quickly detected and corrected. The committee believes, in fact, that the laborers would rather work 12 hours and earn the extra money, since the intermittent nature of their duties requires less total exertion than an 8-hour shift in many other trades.

Intricate economic questions also have a great bearing on the decision. In view of the demands of commerce, local and international, it is necessary that a great amount of iron and steel products be created at the lowest possible cost. The short shift would derange this desirable state of affairs by increasing the selling price about 15 per cent. Furthermore 60,000 additional employees would be needed, but could not be found—in fact, there is a serious labor shortage at the mills now.

While the 12-hour day can gradually be eliminated during periods of large labor supply, the committee, having in view the sentiment of the employees, employers, purchasers and general public, cannot now recommend the abolition of the 12-hour day, but promises that it will be done should the general public and the laborers concerned demand it, and purchasers of the metal become willing to pay the advanced cost.

Gary Says European Common People Are War Weary

Judge Gary, the president of the Institute, then continued with his formal address. For the most part it consisted of an account of a recent tour throughout the Near East, and a religious homily inspired by the devout, industrious and war-weary people he saw there. His audience revived its interest when he mentioned the Ruhr. Without commenting on the political situation involved, he deplored the appalling damage caused to both sides and to neutrals. He felt that the common people in France, Belgium and Germany would be very glad to break the deadlock, and that speedily. Perhaps the submission of the dispute to a neutral nation or jurist as arbitrator would be the best solution.

Before reaching the usual business survey, in which he could see no reason to doubt continued operations at capacity for the next 6 months, Judge Gary's voice and strength broke, and he was forced to ask another to continue the reading, meanwhile leaving the rostrum.

In the forenoon session, a brief account of the utility of chemical analysis was given by W. A. Forbes of the U. S. Steel Corporation. He pointed out how raw materials are selected and how furnace operations and products are controlled by repeated analyses. Since smelting and refining operations are essentially chemical reactions occurring at elevated temperatures, modern practice owes much to the rational application of chemical theory. "The electric furnace process could not have been developed without it, since this process involves a more scientific application of chemistry than all other steel processes combined." Recognizing that variations in steel quality are caused by small amounts of dissolved gases or chemical compounds which at present cannot be isolated or determined, the speaker asked the question, "How may further progress in the application of chemistry to the iron and steel industry be maintained? The answer is: In untiring and unremitting research."

Bradley Dewey, of the Dewey & Almy Chemical Co., in commenting on the foregoing paper, stressed the fact that general chemical theory should be of greatest aid to the steel industry of the future, which will require a great number of men of vision and scientific training to correlate existing data from many fields. After mentioning the tremendous success that has followed the introduction of physical metallurgy to the study of alloy and special steels, he predicted an entirely new metallurgy, with its host of new problems, when oxygen gas may be had for less than $5 per ton. He ventured even to predict a sizable tonnage of iron, coming as a byproduct from nitrogen fixation processes.

Gas Producer Operation

Waldemar Dyrssen, of the U. S. Steel Corporation, presented a voluminous study of "Gas Producer Practice." He had long been aware that the equilibrium diagrams between hot carbon, air and steam, determined in the laboratory, were inapplicable to gas producer studies, simply because gas rushes through the hot fuel bed so rapidly that the time element is lacking. So he attacked the problem from the other end. Possessing detailed studies of a number of producers, he worked back to what might be called the kinetic equilibrium of the producer. From such derived data he was able to draw most useful conclusions regarding all factors playing a part in coal gasification. He was also able to determine the optimum temperature of blast and gas. He showed that it is possible to control operations closely by merely regulating the temperature in the gas main. Ordinary bituminous coal when treated properly will produce the following gas: C_2H_4, 0.6 per cent; CH_4, 3.6; CO, 29.1; H, 13.3; CO_2, 3.4 and N, 50.0 (exclusive of H_2O and tarry vapors).

Disintegration of Firebrick

After an examination of the shattered firebrick in a blast-furnace lining, C. E. Nesbitt and M. L. Bell, research engineers of the Carnegie Steel Co., concluded that disintegration was due to reactions between Fe_2O_3 in the brick and CO in the furnace atmosphere. Reaction at 325 to 525 deg. C. is fairly rapid, depositing voluminous graphitic carbon, which bursts the brick into many pieces. It is apparent that a brick very free in ferric oxide should be used for blast-furnace linings—to test this point samples may be heated for 6 hours at 450 deg. C. in an atmosphere of CO. If the brick remains intact, it will not disintegrate from carbon deposition; if the sample breaks during the test, such brick should not be included in the furnace lining.

How Does Production Affect Profits?

Above a Given Production Value the Total Profit on a Commodity Becomes Less—Below That Value the Total Profit Has Not Reached Its Maximum—This Article Discusses Both Why This Is So and How the Optimum May Be Determined

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IN THE operation of manufacturing plants it is a principle thoroughly appreciated that production should be forced to the utmost limit not inconsistent with efficiency in manufacture and with the disposal of the product. This principle is sound, but its formulation is indefinite and vague. The object of this discussion is to develop an exact criterion for the application of the principle, in order to make it more useful in the control of industrial practice.

As the basis of the dicussion there will be assumed a definite plant producing one specific article. It will be granted that the plant is operating on a definite schedule and is being managed in the most efficient possible way. In the control of such a plant there is, however, one variable of paramount importance which can be effectively manipulated by the management—namely, the production to which the plant is forced. The object of discussion is to determine the optimum production at which the plant should be operated.

In any plant unit costs can be subdivided into three major categories. The first of these can be designated as organization costs. The existing plant and physical equipment represent an investment on which a return must be paid. Furthermore, in order to operate the plant on any scale commensurate with its capacity, there must be maintained a personnel for management and supervision, which, though nonproductive, is a prerequisite to production. The cost of maintaining this whole organization, including both physical equipment and directive personnel, represents an unavoidable expense, which remains practically constant so long as operation is kept up. All changes of this description should be grouped together as *organization costs*. Such expenses are obviously made up of investment charges, taxes and insurance, include management and superintendence, and perhaps, in some cases, office expenses, and the like.

The second category is best described as *production costs*, and consists of items of which usually the major are labor and materials, charges that are practically proportional to the production of the plant regardless of the rate of production.

Finally, in the third category, which will be called super-production costs, fall a series of charges that increase more rapidly than production. Among the most important of these are depreciation, maintenance and repairs. In a plant that is running at a low production these items can, with careful management, be kept down to a very low figure; even when expressed as unit charges per unit production the figures will be moderate. When, however, it is attempted to force plant and processes, the wear and tear thereon increase and the upkeep expenses mount out of all proportion to the production. To the items enumerated above, there should be added in this third category those charges covering the decreased efficiency of labor that always results from forced production. For example, losses due to rejections of product upon inspection are of this character. In some cases, these last items are of paramount importance. (One of the advantages of the piece price system lies in the fact that the exact cost of securing increased productivity of labor, whether through the production bonus or otherwise, can so readily be determined.)

The novice in managerial work is prone to focus attention solely upon methods of reducing costs. It is often more effective to develop methods for wisely increasing costs. An improvement in production method resulting in reduced cost should be forced, often to the point where cost is actually increased, because by so doing production can be increased to more than compensate therefor.

It will, therefore, be tentatively assumed that charges can be distributed among these three categories: organization costs, production costs, and super-production costs.

If in a given plant the production be small, the unit costs will be high, because the organization costs are distributed over a small production. With increased production the organization costs are distributed over a wider area, and the unit costs go down accordingly. But if production be carried further, the influence of the super-production costs referred to above will become evident, and the inefficiency of production caused thereby will tend to compensate for the lower organization costs per unit production. Thus costs will no longer decrease with further increase in production. Indeed, if production be forced to a still further degree, costs will actually increase. As a result of these relationships the cost of production in any plant is determined by the total production of that plant, and furthermore, with increase in production the cost curve first decreases rapidly, then becomes constant at a minimum cost, and finally increases due to the action of super-production costs. While the cost curves of no two plants and no two products will be the same, the general shape of these cost curves is always that outlined above, and is shown graphically in Fig. 1.

Tentatively assume that the product discussed above is one that is sold on specification. Then the quality of that product must be maintained up to standard in order to move it, but need not be pushed above the standard. Assume, furthermore, that the plant in question produces such a small fraction of the total consumption of its market that any variation in its own pro-

duction does not appreciably affect the price in that market. In such a case the selling price of the product will be a constant quantity, independent of the production of the plant.

The profit per unit product is obviously the difference between the selling price and the cost, it being assumed either that the costs mentioned above are the true total costs including the selling expenses, or else that the selling price is net selling price—i.e., total price less the selling costs. (This alternative should be adopted only when the product is sold by an outside organization at a fixed figure—e.g., on a commission —because selling costs, like all costs, fluctuate with the value of product handled) The profit per unit product will, therefore, be determined by the production of the plant, the curve being of the shape of the cost curve upside down. These three curves are indicated in Fig. 2.

The total profit from this plant is obviously the unit profit times the total production. Inspection shows that the unit profit curve passes through zero at the two points where the cost curve cuts the selling price curve. Since the total profit is the product of unit profit times production, the total profit curve must also pass through zero at the same points. It is evident also that the general shape of the total profit curve must be similar to that of the unit profit curve, and since it starts from and returns to zero, the total profit curve must at some intermediate point reach a maximum, and this maximum is the point of optimum production at which the plant will earn the largest possible return on the investment and profits for the management.

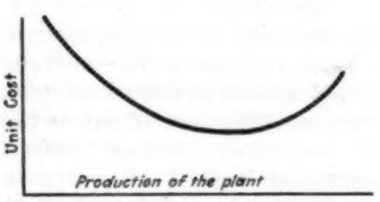


FIG. 1

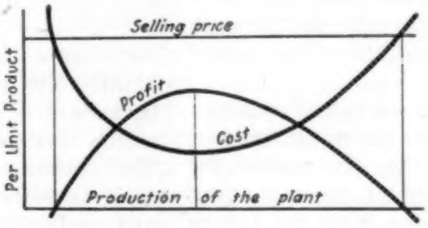


FIG. 2

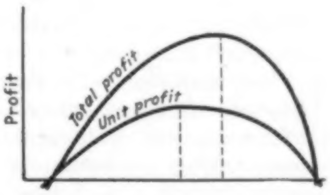


FIG. 3

Total Profit and Unit Profit

It is obvious that, for the case assumed, the unit profit curve goes through a maximum at a production corresponding to the minimum of the unit cost curve. At this maximum point, however, the unit profit curve is flat. This means that, if at this maximum point the production be slightly increased, the unit profit does not appreciably decrease. The product of unit profit into production must, therefore, increase. The consequence of this is that at the point of maximum unit profit the total profit curve—i.e., the product of total production into unit profit—is still increasing, and therefore the maximum of the total profit curve must lie to the right of that of the unit profit curve. (Fig. 3.) If, therefore, production be forced beyond the point of maximum unit profit, total profit will be increased. Inasmuch as the plant should be operated at the point of maximum total profit, this means that the plant should be forced at the sacrifice of an increase in unit cost in order to realize the maximum return.

This relation between cost and production is the key to the whole situation. It means that low costs of production are not a sufficient criterion of efficiency in plant management. A properly run plant can always reduce its costs by reducing its production, but thereby it would also reduce its profits. A management that is too anxious to keep costs down is likely to err in this regard, especially during periods of high prices. For example, during the early years of the war prices were so high that almost any increase in cost which brought about an increase in production was justifiable, because the increased production overbalanced the increased cost. Production costs must be scientifically adjusted to correspond with the market of the product.

Production costs are often used as a basis of judging managerial ability. This is peculiarly unfair, because the truly efficient manager will have higher production costs than the man, with equal technical ability, who is striving for low costs without an appreciation of the importance of a proper balance between costs and production. A direct comparison of the production costs of two plants or departments is inadequate and inconclusive. Efficiency in plant management will result in a low cost *curve*, but the more efficient of two plants may necessarily run at a production cost which is actually higher than that of the other. This fact is largely overlooked by industry.

With a variation in selling price the height of the unit profit curve changes, and the shape of the total profit curve is also modified. With increased selling price the unit profit increases and the total profit curve is bent toward the right so that the maximum point of the total profit diagram is forced to a point of higher production. With decreasing selling price the opposite is true—i.e., the maximum of the total profit curve not only decreases but also moves toward the left.

Two special cases are of interest. First, let it be assumed that selling price falls to such a point that it is exactly equal to the minimum cost of production corresponding to the lowest point on the unit cost curve. In such a case the profit is negative in value, except at a production corresponding to the minimum of the unit cost curve, at which point the unit profit becomes zero. If the total profit curve be constructed (Fig. 4) it will also obviously be negative at all values except at this same point, where it will have a "maximum" as before, but this "maximum" will be zero profit. Obviously, therefore, the plant under these conditions should be operated at the point of minimum cost, because at this point no money is being lost, whereas at any other production a loss will be sustained.

If the selling price be further reduced, the plant must obviously run at a loss. The unit profit curve (Fig. 5) is still the difference between the cost of production and selling price, but is now negative—i.e., becomes a unit loss, throughout its extent. The total profit curve also becomes negative—i.e., represents a loss—but it still has the same general shape as before, and still has a highest point, if considered as a profit, and a lowest point, if considered as a loss. This point will lie to the left of the point of lowest cost of production, and, if the plant be operated at this production, the loss on

the plant will be a minimum. Obviously this is the point of best economic operation.

Evidently a plant will not operate under such conditions except in the following cases: The first case is when the management feels that there is reasonable expectation of a future increase in selling price so that the plant will again produce a profit. The other exists when the total cost includes fixed charges which, though entirely legitimate because they represent an earning capacity of the money invested which can be realized in other similar lines of business, must be sacrificed because liquidation of the business would involve a loss in capital so great that the total return in interest on the capital salvaged would be less than the money actually earned for interest charges by the plant as it stands. Such conditions, however, so frequently prevail that the criterion outlined above for determining the best operating conditions is usually applicable.

It is not intended to intimate that these curves should be used as a rigid criterion of production. Labor conditions, future prospects of the market, the situation with regard to raw materials, and the like, are factors of paramount importance in determining modifications of production policy. On the other hand, the curves outlined above serve as an indication of the direction in which production should be modified, and of the extent to which it is desirable to go.

For example, in the case of a plant operating at a loss because of selling prices falling below the minimum cost of production, it is usually stated that the reason for maintaining operation is to keep intact the managing organization, and to keep available the labor for future expansion. This is quite true, but it is also true, as above demonstrated, that there is a definite production condition to which corresponds a lowest loss at which the plant can be run, and obviously under such a market situation this minimum loss should, if possible, be real-

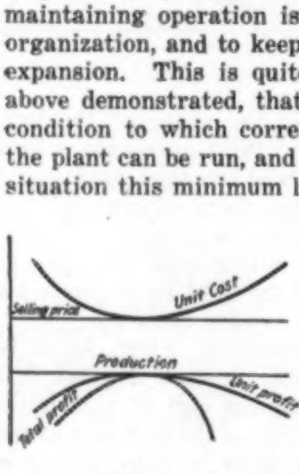


FIG. 4

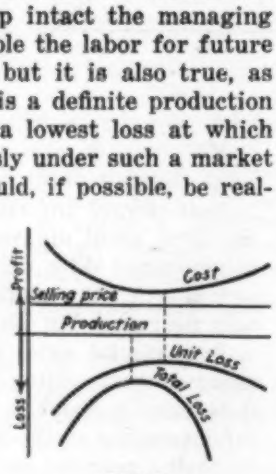


FIG. 5

ized. Furthermore, this minimum loss can easily be realized without materially interfering with the maintenance of an organization and a suitable labor supply, because, under such conditions of manufacture as here assumed, it is usually possible to control the labor supply within wide limits by modifying the total hours of labor, and to maintain as a working organization the most desirable individuals to serve as a skeleton for future development.

The above discussion has been based on the tentative assumption of uniform selling price under given market conditions; this assumption, however, is in nowise necessary to a utilization of the curves and of this method of analysis of production costs, but was adopted solely to simplify the first presentation of the concept. Usually with an increased output the selling price of the product decreases more or less rapidly, due to the increased supply on the market or to a tendency of the product to fall in quality with increased production. In other words, the selling price curve assumes the shape indicated in curve *A*, Fig. 6. This modification of the selling price curve will somewhat modify the general shape of the unit profit and the total profit curves. A marked increase in production may result in a price curve of type *B*, involving the necessity of sharp decrease in price in order to open up new uses and markets to absorb the increased supply of the material. The maximum of the total profit curve is still the point of optimum production, and, in general, the selling price curve is sufficiently flat at the point of minimum cost of production so that the maximum point of the total profit curve lies to the right of this point. This is always true in a properly designed plant—i.e., in a plant the size of which is properly adjusted to the market for the product. Unfortunately the war placed many plants in the wrong category.

In using these curves, construction of the unit cost

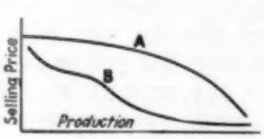


FIG. 6

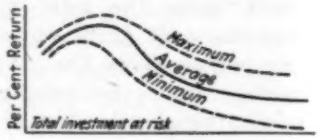


FIG. 7

curve as a function of production is the first essential point. The cost curve must in general be estimated, because it is not usually practicable to determine actual points thereon by arbitrary modifications of production. The estimation of this cost curve becomes relatively easy, however, if the production analyst will rearrange and reclassify, along the lines already described, the data available in the cost department. To make the classification and interpretation of these data reliable, the analyst must secure the close co-operation and advice of the cost department and especially of the operating engineers, because the data for any given plant can be interpreted correctly only in the light of a clear appreciation of the conditions and methods of operation in that individual plant. Subdivide costs into organization, production and super-production costs. The operating department can give a reasonable estimate as to the change of the last with increased or decreased production, and this rate of change of super-production costs with production is the only item seriously influencing the shape of the cost curve which it is difficult to estimate. The point on the cost curve corresponding to actual production being definitely and accurately known, it thus becomes possible to get a close estimate on the costs for any other production which differs not too greatly therefrom.

In determining the distribution of special items of cost the decision must depend upon the influence upon these items of change in production. For example, while raw materials almost always fall under production costs, direct labor is often an organization cost. Thus most of the labor about a blast furnace should be charged to organization and not to production, because the nucleus of the labor staff must be maintained to keep the furnace in operation at all, whether the production of the furnace be high or low, and in the case of such a furnace the labor nucleus is a large proportion of the total labor. The factor limiting the production of a blast furnace is the life of the lining. Again, the day-rate spinner in a textile mill should be charged to organization, because the number of spinners is fixed by the number of frames in operation, not by the speed, and hence the production of those frames. Doffing, however, is a production cost.

Similarly in each specific case the character of each item of cost can be determined.

The cost curve once established should, in a given plant, be relatively stable. It will, of course, be influenced by changes in prices of raw materials and in wages, but the influence of these changes can be readily estimated. The selling price will, in general, be much more subject to fluctuation. At regular periods, the length of which will vary from industry to industry, depending upon the rapidity of fluctuation of the selling price, the charts indicated above should be constructed and placed before the management as a guide in directing policy with regard to production.

Arghan—A New Fiber

THE cheapness of cotton during the past half century has militated against the introduction of a substitute, but it is interesting to note that the pioneer of the plantation rubber industry, Sir Henry Wickham, realized the possibilities of a plant, now known as arghan, about 50 years ago; but economic conditions during the intervening period did not warrant its cultivation and exploitation. More recently, however, because of the high price of cotton and flax, the inroads of the boll weevil and other factors of economic and international importance, attention was paid in Great Britain to the possibility of the transporting of arghan plants and their cultivation on a large scale. Russia, before her economic collapse, was an important producer of flax. This source is now almost entirely barren, with the result that a shortage of over 500,000 tons per annum must be met by the substitution of other material. A company to develop the arghan industry was organized in London late in 1919, with Sir Henry Wickham as technical adviser.

Transplanting the Plants

As with the beginning of the rubber industry, investigations were made and steps were taken to transplant a large number of arghan plants from their native habitat in the wilds—the precise locality is a secret—and to establish them in a desirable area in the British dominions. From this fact it would appear that arghan, like rubber, is indigenous to a country in which exploitation would be economically impracticable, because of governmental or national instability, of the probability of hampering interference with exportation, or restrictive if not confiscatory legislation. The collection of the plants and their transport to the Federated Malay States proved a delicate task, as was the case with the rubber seeds that were surreptitiously removed from Brazil. More than 500,000 plants were collected, the time involved being over 12 months; of these, less than 4,000 arrived alive at their destination. However, careful attention only was needed to preserve the stock, and recent reports indicate that the success of the enterprise, from the technical standpoint at least, has been complete. A nursery was established far from the native habitat of the plants. Various governments within the British Empire showed a keen desire to co-operate. The government of the Federated Malay States first granted the company a concession of 30,000 acres free of all premium, with a nominal land rent of 50 cents per acre, rising to a maximum of $1 per acre. The value of this concession is indicated by the fact that the rubber companies thereabout pay $4 per acre per annum for the same privileges. This indicates that the colonial government must have been satisfied as to the merits and possibilities of the new fiber. More recently, other colonial governments have evinced a desire to facilitate the expansion of the new industry, and negotiations are under way with India and Ceylon.

Character of the Fiber

Arghan is a perennial, and therefore is easier to produce than cotton or flax (being less liable to the effect of seasonal variations), both of which are annuals. Maturity is reached within 2½ years after planting. The fiber is of unusual strength and resistive power, particularly in regard to salt water. Tests have shown that when fabricated it can bear a strain of 50 per cent above the same class of goods manufactured from Italian hemp or Russian flax. A tensile strength three times that of silk and, weight for weight, the same as steel has been claimed. The fiber content of the leaf amounts to about 20 per cent of its weight, as compared with 3 to 4 per cent in sisal hemp. The analysts to the Federated Malay States Government state that it contains 75 per cent of cellulose, which is above the average for fiber of this class; that it resists alkaline hydrolysis, and that it is remarkably free from lignone. Immersion in salt water for several months showed that the fiber possesses a high degree of chemical resistance. One pound of arghan has been spun into 7,500 yards of material, and even improved results are expected when its properties are better understood. It has been shown to have satisfactory adsorptive qualities, and to take dye satisfactorily. It also bleaches well. The new fiber, which is obtained from the leaf, differs from ramie in that no decortication and degumming difficulties are met with. The method of treatment for the recovery of the fiber is simple, cheap and effective.

A committee of Lancashire manufacturers and spinners has reported that the new fiber will be suitable for twine, cordage, fishing-net yarns, tapes and beltings; and that it will eventually displace cotton from all classes of heavy canvas, particularly where strength is of paramount importance. As to the cost of producing arghan under methods involving scientific plantation control, Sir Henry Wickham states that the plant that yields the fiber is now being placed under cultivation for the first time, and that all estimates are tentative. But, as it belongs to a botanical order characterized by unusual hardiness and rapid growth, it is more than probable that an industry may be established and maintained over large areas of suitable land in the Eastern tropics, at a lower cost than is possible with any other staple product. A preliminary estimate shows that arghan can be produced and marketed for less than 12 cents per pound to yield a satisfactory profit.

Development of the Industry

The parent corporation has instituted a plan for the development of the new industry, whereby subsidiary companies are formed and financed to develop plantations of 5,000 acres each. More recently arrangements have been made with the rubber companies in the Federated Malay States, whereby they are permitted to produce and sell arghan on a royalty basis. This fact is of significance to those interested in the supply of crude rubber. It indicates that the restricted output of plantation rubber may not end in financial disaster to the growers, as has been predicted by manufacturers who would welcome a radical reduction in price.

Machinery and Appliances for Production and Control

Equipment News

From Maker and User

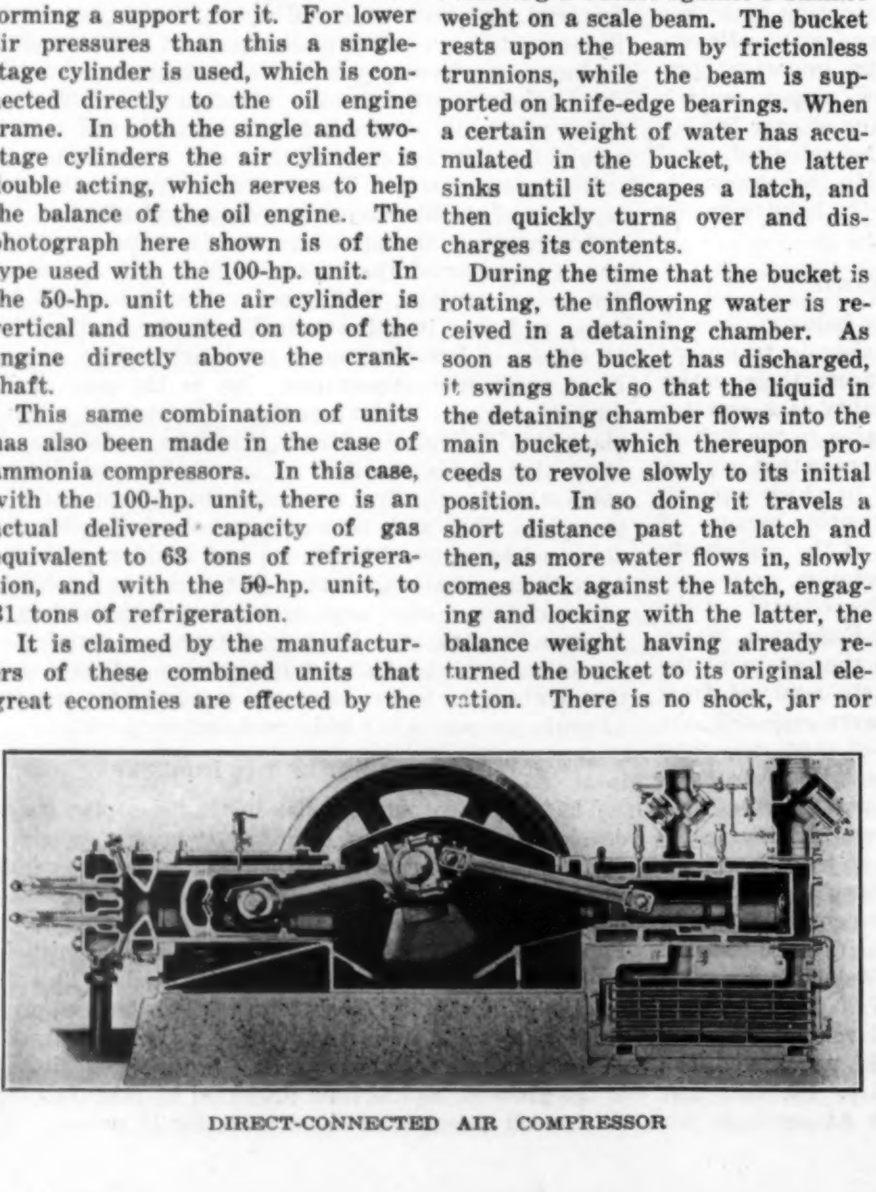
Materials and Accessories for Chemical Industries

Direct-Connected Air Compressor Unit

The accompanying photograph shows an extremely interesting development of the Price horizontal oil engine which has recently been made by the Ingersoll-Rand Co., of 11 Broadway, New York. In this photograph is shown an oil engine with its cylinder directly in line with the air cylinder of a compressor set on the opposite side of the crankshaft. In the development of 100 lb. air pressure, a two-stage air cylinder is used, with the intercooler situated below the cylinder and forming a support for it. For lower air pressures than this a single-stage cylinder is used, which is connected directly to the oil engine frame. In both the single and two-stage cylinders the air cylinder is double acting, which serves to help the balance of the oil engine. The photograph here shown is of the type used with the 100-hp. unit. In the 50-hp. unit the air cylinder is vertical and mounted on top of the engine directly above the crankshaft.

This same combination of units has also been made in the case of ammonia compressors. In this case, with the 100-hp. unit, there is an actual delivered capacity of gas equivalent to 63 tons of refrigeration, and with the 50-hp. unit, to 31 tons of refrigeration.

It is claimed by the manufacturers of these combined units that great economies are effected by the use of an oil engine in connection with a compressor. In making a comparison with electrically driven units, it is claimed that with fuel oil at 6 cents per gallon the oil-burning engine works on a par with electric power at 1¼ cents per kw.-hr., and with fuel at 12 cents per gallon with electric power at 1½ cents per kw.-hr.

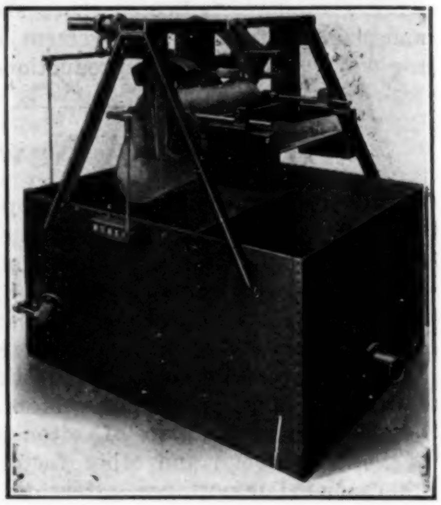


DIRECT-CONNECTED AIR COMPRESSOR

A Weighing Meter For Liquids

The weighing meter shown herewith actually weighs the liquid by balancing a bucket against a balance weight on a scale beam. The bucket rests upon the beam by frictionless trunnions, while the beam is supported on knife-edge bearings. When a certain weight of water has accumulated in the bucket, the latter sinks until it escapes a latch, and then quickly turns over and discharges its contents.

During the time that the bucket is rotating, the inflowing water is received in a detaining chamber. As soon as the bucket has discharged, it swings back so that the liquid in the detaining chamber flows into the main bucket, which thereupon proceeds to revolve slowly to its initial position. In so doing it travels a short distance past the latch and then, as more water flows in, slowly comes back against the latch, engaging and locking with the latter, the balance weight having already returned the bucket to its original elevation. There is no shock, jar nor impact at any time during the operation.



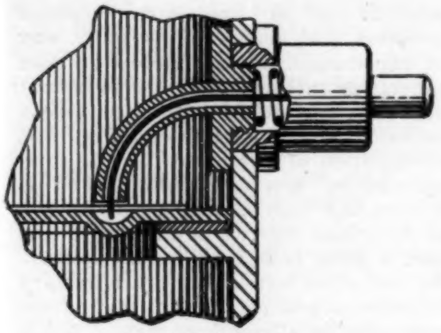
WEIGHING MOTOR WITH OPEN TANK

The bucket trunnions roll upon plane surfaces and there is practically no wear. Each dumping is registered by a counting train. The accuracy is within 1 per cent, plus or minus, at all rates of flow up to the maximum. The meter is easily calibrated by weighing a single discharge and can be adjusted by moving one or both of the counterweights.

This weighing meter can be built in small capacities for which a V-notch would be unsuitable. The receiving tank into which the meter discharges can be fitted with a float controlling a valve in the inlet connections, where the amount is controlled by the apparatus to which the liquid flows rather than by the apparatus from which it comes. This meter is being marketed by the H. S. B. W.-Cochrane Corporation of Philadelphia, Pa.

Time Punch For Recorders

As an additional feature in connection with the "Columbia" line of temperature recorders made by the Schaeffer & Budenberg Manufacturing Co., of Brooklyn, N. Y., a time punch has been added. This feature consists of a punch located



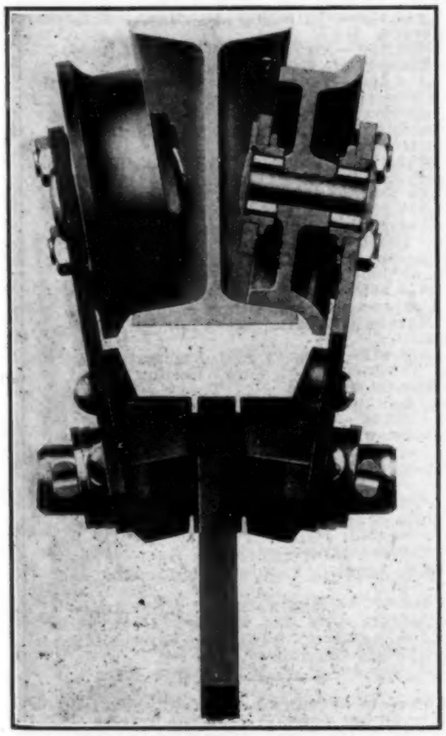
TIME PUNCH

in the rim of the recorder, as shown by the accompanying drawing. When the button is pushed the curved wire makes a perforation in the recorder chart—indicating the time of the punching operation. This feature obviously has numerous uses, such as recording the time at which certain operations are performed or readings taken, or it may be made to serve as a watchman's clock or for similar purposes.

An I-Beam Trolley

The Yale & Towne Manufacturing Co., of Stamford, Conn., has recently designed and placed on the market a new I-beam trolley of the roller-bearing steelplate type. This trolley represents the latest features of this company's trolley design and embodies the following features:

Strength—A reserve of seven times the rated capacity.



SECTIONAL VIEW, YALE TROLLEY

Flexibility—A 1-ton trolley will run on a 21-in. radius curve.

Roller Bearings—These are heat-treated, hardened and ground to give easy lateral motion. They have a grease chamber designed to prevent the dust from reaching them.

Axles—These are set parallel to the I-beam flange, pressed into the wheel hubs and supported by the inner bearing plate. In this way they are subjected to practically no bending strain.

Wheels—These are chilled iron threads conforming to the shape of the I-beam flange, designed to reduce the wear from dust and grit.

Equalizing Pin—This is of cold-rolled steel and will support a shackle, an eye, or a clevis. Where extra headroom is desired, the chainblock can be hooked directly over this pin.

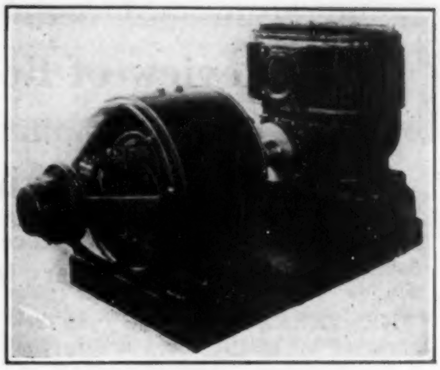
In demonstration of the strength of this trolley, the manufacturer offers the following test: The trolley was loaded with a 28,000-lb. load and the I-beam on which it was supported broke without any damage occurring to the trolley.

Temperature Regulator

The Fulton Co. of Knoxville, Tenn., has recently placed on the market a new temperature regulator which it calls No. 932. This regulator is the latest member of "Sylphon" line of temperature regulators, and is used for regulating the temperature of liquids.

It consists primarily of a thermostatic element, a power transmission unit and a regulating valve. It is in three parts and so arranged that the thermostatic element can be installed in the tank containing the liquid whose temperature is to be regulated, independently of the installation of the outer parts. The valve in the steam line can also be independently installed. After the installation of these two parts, the power transmission unit can be connected between the two, by means of a quick-detachable T-slot connection.

Power between the thermostat and the regulating valve is transmitted by liquid pressure acting betwen two small "Sylphon" bellows. The liquid contained in this system is a non-freezing liquid which is recommended by the manufacturers as giving frictionless and satisfactory operation. The bellows are of the "Sylphon" corrugated metal type.



THE NEEDHAM BLOWER

Needham Blower

Many offices, such as telephone and telegraph companies, brokers' offices and newspaper offices, use pneumatic conveyor systems for handling papers and other materials between various rooms. For this use, the Needham blower has long had much popularity. In fact these blowers are in use in all the best known telegraph, cable and telephone companies.

The satisfactory operation and many good qualities of this machine, whether used as blower or exhauster, have recently impelled the manufacturers to recommend it for other uses. It is offered for the attention of chemical and allied industry as a solution of some of the problems which are here met with in obtaining satisfactory blowing equipment.

This machine is built in capacities from 75 ft. to 1,500 ft. per minute. It is direct connected through a flexible coupling to a motor mounted on the same base. It has ball bearings throughout, which makes for efficient operation and permits of easy replacements.

The drive is from the motor to a worm which is direct connected to the motor shaft. This worm drives two worm-wheels, one on each shaft of the blower. By this means, power is transmitted evenly to each shaft and any spring in shafts or impellers is eliminated. The impellers are cast integral with the shafts. Shafts are vertical. The general design is along similar designs to that of other well-known positive blowers.

The manufacturers claim that in this machine they have a blower of great reliability which is noiseless; and that it is particularly adapted to automatic control. It is also claimed that it develops double the capacity, for a given size, of any other type of blower.

Review of Recent Patents

Some Hints for the Technical Man

Patents Dealing With Cane Juice Purification, Wool Cleaning and Paper Recovery Deserve Attention

THE TREND of industry as revealed by patent literature in the last decade shows a marked increase in the number of new alloys patented. This is significant. It is an indication of the increasing attention that is being focused on the scientific production of alloys and metallic products. Less and less the old cook-book methods, more and more an intelligent application of clear-headed, planned experimentation.

This observation was stimulated by a patent on the manufacture of silicon-manganese-iron alloys. (1,449,373, issued to W. J. Beck and J. A. Aupperle, assigned to the American Rolling Mill Co. of Middletown, Ohio; March 27, 1923.) By the addition of 2 to 4½ per cent silicon to iron to which has also been added manganese, a corrosion-resistant alloy is produced. The addition of manganese to an alloy increases its workability. The theory is that the iron alloyed with silicon when exposed to natural oxidation takes on a thin, velvety, protective coating, made up largely of black magnetic oxide of iron, together with silicate of iron. The silicon in the alloy prevents the formation of higher oxides upon the surface of the metal. This coating acts as an enamel covering on the surface of the metal, preventing formation of ordinary rust-ferric oxide, Fe_2O_3.

Purifying Raw Cane Juice

The cost and time required in the purification of raw cane juice are excessive and all effort expended on the diminution of these invaluable commodities is in line with economic progress and health. This is by way of explanation of our interest in such patents as this one (referred to below) and to enunciate from time to time a useful criterion of attention value. The clarification of raw cane juice is complicated by several factors. If it is filtered and then neutralized with milk of lime and filtered again, the filtration is slow, unless a filter aid is used. On the other hand, if the preliminary filtration is omitted, the fine fibers from cane give up albuminous matter which is coagulated on neutralization and heating. This makes filtration extremely difficult. C. J. G. Sorenson, of Frederiksted, Virgin Islands, has patented a method for handling this problem. (1,448,421; March 13, 1923.) The raw juice is neutralized with milk of lime and heated under 40 lb. pressure to a temperature of 110 deg. C. The juice still contains the small fibrous particles, bagacilio, of cane. By pumping directly to a filter press out of contact with air, the albuminous matter is kept from coagulating.

Advance in Paper Technology

The increasing cost of new stock for paper manufacture is creating a condition that makes improved recovery

American Patents Issued May 22, 1923

The following numbers have been selected from the latest available issue of the *Official Gazette* of the United States Patent Office because they appear to have pertinent interest for *Chem. & Met.* readers. They will be studied later by *Chem. & Met.'s* staff, and those which, in our judgment, are most worthy will be published in abstract. It is recognized that we cannot always anticipate our readers' interests and accordingly this advance list is published for the benefit of those who may not care to await our judgment and synopsis.

1,455,785—Screening and Sizing Process and Apparatus. G. C. Hackstaff, Denver, Colo.

1,455,789—Apparatus for Automatically Extinguishing Fires in Oil Tanks and Other Structures. O. J. Holmes, Tulsa, Okla.

1,455,791—Flux or Solvent for Use in Technical Process. A. A. Kelly, London, England, assignor to Borax Consolidated, Ltd., London.

1,455,809—Elastic Gasket Composition. J. Ritter, Pittsburgh, Pa., assignor to Whitaker-Glessner Company, Wheeling, W. Va.

1,455,834—Method of and Apparatus for Cleaning Gases. A. N. Diehl, Duquesne, Pa.

1,455,846—Air-Conditioning or Humidifying and Heating System. L. L. Lewis, Plainfield, N. J., assignor to Carrier Engineering Corporation, New York.

1,455,893—Unvulcanized Rubber Composition. F. W. Stockton, Pittsburgh, Pa. assignor to Aluminum Seal Co., New Kensington, Pa.

1,455,907—Vibrating Trommel Screen. A. C. Daman, Denver, Colo.

1,455,911—Oil Purifier. A. R. Giffin, Cleveland, Ohio, assignor to J. E. Heene, Cleveland.

1,455,927—Method of and Apparatus for Preventing the Absorption of Air by Boiler-Feed Water or Other Liquid. D. B. Morison, Hartlepool, England.

1,455,963—Lithopone and Method of Manufacture. V. F. Meister, Collinsville, Ill.

1,455,966—Mechanism for Conveying Hot Glassware. M. J. Owens, Toledo, Ohio, assignor to Owens Bottle Co. Toledo.

1,455,975—Apparatus for Puffing or Disintegrating Material. A. R. Spencer and W. J. Plews, Cleveland, Ohio.

1,455,995—Bleaching Earth. C. Cramer, Zurzach, Switzerland.

1,456,016—Liquid Heater and Vaporizer. C. E. Ward, Charleston, W. Va.

1,456,019—Process for Extracting Oil. H. A. Wentworth, Deer Island, N. B., Canada.

1,456,023—Furnace Arch Construction. L. H. Hosbein, Chicago, Ill., assignor to M. H. Detrick Co., Chicago, Ill.

1,456,035—Metal Dust and Process of Making the Same. M. H. Newell, San Francisco, Calif., assignor to the Alloys Co., San Francisco.

1,456,044—Positioned Electrode. W. W. Strong, Mechanicsburg, Pa., assignor to Research Corporation, New York.

1,456,057—Fuel Economizer. W. G. Griffin, Washington, D. C.

1,456 064—Process and Apparatus for Making Sulphuric Acid. W. F. Lamoreaux, Isabella, Tenn.

1,456,065—Manufacture of Sulphuric Acid. W. F. Lamoreaux, Isabella, Tenn.

1,456,067—Apparatus for Screening Granular Materials. R. A. Leahy, Bonne Terre, Mo.

1,456,095—Pressure Oil Filter. F. E. Collins, Conshohocken, Pa.

1,456,102—Chemical Apparatus. B. B. Fogler, Cleveland, Ohio, assignor to General Electric Co.

1,456,111—Clay Products and Process of Preparing Same. E. G. Acheson, New York.

1,456,112—Reflocculated Product and Process of Preparing Same. E. G. Acheson, New York.

1,456,147—Agitating Device. T. J. Putnam, Boston, Mass.

1,456,165—Ore Separator. S. H. Whitney, San Francisco, Calif., assignor of one-fourth to A. A. Eddie, San Francisco.

1,456,224—Method and Machine for Making Prepared Roofing. A. E. Currier, Millis, Mass., assignor to Baker Rubber Cement Co., Boston.

1,456,252—Process of Coating Metals with Metal Phosphides. S. Peacock, Wheeling, W. Va., assignor to Wheeling Steel & Iron Co., Wheeling.

1,456,255—Apparatus for Heat Exchange. E. Shaw, Toronto, Ont., Canada.

1,456,270—Sugar-Washing and Water-Measuring Device. W. W. Hartman, Los Angeles, Calif.

1,456,274—Process of Rendering Metal Non-Oxidizable and the Metal. W. J. Keep, Detroit, Mich.

1,456,303—Acid-Proof Mortar. P. G. Ekström, Stockholm, Sweden, assignor to Aktiebolaget Syrefast Murning, Stockholm, Sweden.

1,456,312—Combined Sludge Separating and Drying Basin. K. Imhoff, Essen, Germany.

1,456,323—Process for Treating Woods and Other Porous Substances. E. H. McPherson, Los Angeles, and J. M. Abrams, San Francisco, Calif.

1,456,332—Process of Drying and Preparing Fertilizing Materials. F. J. Nash, Brooklyn, N. Y.

1,456,341—Explosive Composition. W. O. Snelling, Allentown, Pa., assignor to Trojan Powder Co., New York.

1,456,353—Mill. D. D. Bare, West Jefferson, N. C.

1,456,360—Air Filter. A. Budil, Berlin-Tempelhof, Germany.

1,456,360—Thermoplastic Composition and Process of Compounding the Same. E. de Stubner, New York, assignor to Columbia Graphophone Manufacturing Co., Bridgeport, Conn.

1,456,370—Process of Making Waterproof Rigid Articles from Pulp. W. H. Drake and J. J. Drake, Cleveland, Ohio.

1,456,390—Safety Device for Plants Delivering Inflammable Liquids. M. Ludwig, Berlin-Lichterfelde, Germany, assignor to Martine & Hüneke Machinenbau-Aktien-Gesellschaft, Berlin.

1,456,392—Retort for the Treatment of Carbonaceous or Other Materials. F. D. Marshall, Westminster, London, England.

1,456,419—Process and Apparatus for the Production of Low Boiling Point Hydrocarbons. J. C. Black, Destrehan, La.

1,456,438—Liquid Filter. K. J. E. Hesselman, Saltsjo-Storangen, Sweden.

1,456,486—Compound for Cleaning Aluminum. C. M. Hemen, Washington, D. C.

1,456,492—Surfacing Composition for Highways and the Like. D. M. Hepburn, Philadelphia, Pa.

1,456,494—Oilproof Coating or Impregnating Agent. A. J. Rowland, Cincinnati, Ohio.

1,456,495—Manufacture of Carbon Electrodes. S. E. Sieurin, Hoganas, Sweden, assignor to Höganäs Billesholms Aktiebolag, Helsinborg, Sweden.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

methods for old stock highly desirable. B. M. Baxter, of Cleveland, Ohio, seeks to make possible the recovery of fiber in waste paper contaminated by various foreign materials. (1,451,522, assigned to Air Reduction Co. of Pittsburgh, April 10, 1923.) In principle the apparatus consists of a long rotating slotted drum suspended partly submerged in a tank of water. The drum is provided with openings in both ends. Into one end the paper waste is fed. The waste in rubbing over these slots as the drum revolves is reduced to pulp and flows out into the tank. Angle irons are so located as to elevate waste solids to the discharge opening. The process is thus continuous and is claimed to give cheaper and more satisfactory recovery of fiber from refuse than any method now in use.

Zinc Oxide Process

The New Jersey Zinc Co., through J. A. Singmaster and F. G. Breyer, has patented an operating improvement in the Wetherall process. (1,450,704; April 3, 1923.) This process is a preliminary step in the production of zinc oxide and consists in making the zinciferous material ready for the production of zinc oxide. It consists essentially in adding to the charge itself an admixture of porous non-slagging material. This diminishes the tendency to slag and block up the charge—a process that effectively prevents further roasting. Furthermore, the process suggests the use of a layer or bed of this non-slagging porous material between the working charge and the ignition fuel. It is claimed that greater facility of operating is obtained, greater flexibility of operating conditions and correspondingly better yield of well-roasted ore.

"Dry Cleaning" Wool

The removal of dirt and grease from wool without the assistance of a liquid solvent is claimed by H. Y. McBride. (1,449,613; March 27, 1923, assigned to the United States Wool Co.) Gypsum is the degreasing agent, but it must be prepared by burning to a point where it will no longer take up any moisture. In other words, it is completely dead-burned. In addition it is necessary to grind the gypsum to a very fine powder—about 250 mesh. The wool is rotated with the gypsum in a tumble barrel and then removed and shaken free by a dusting process which is standard trade practice. It is claimed that the wool may then be spun and dyed with unusual facility.

Sizing Composition for Paper

A sizing composition especially suitable for the tub treatment of high-grade paper results from the treatment of alum-tanned leather scrap with water at higher temperatures. Pieces of scrap in a tub or vat are washed with water to remove as far as possible the salt and alum. The salt is washed out thoroughly and the solution, consisting of scrap mixed with ten times its weight of water, is heated by steam until the leather has been entirely dissolved. A clear light-colored sizing composition results. This may be applied directly, but the addition of enough alum to give 10 per cent concentration on the basis of the dry leather scrap originally used is recommended. After this addition the mixture should be heated sufficiently to incorporate the alum thoroughly. (1,449,892, issued to P. W. Codwise; March 27, 1923.)

Fireproofing Compound

A cheap method of producing fireproof construction is suggested by W. L. Wooton of Brooklyn. (1,451,485; April 10, 1923.) Essentially it means the impregnation of wood and fiber with calcium chloride with which is mixed small quantity of salt and gypsum. It is prepared by adding to 150 parts of slaked lime and one part of salt a mixture containing 99 per cent by volume of hydrochloric acid and 1 per cent sulphuric acid. This mixture can be used directly for impregnating cotton and other textile fabrics, plaster, wood and so forth. The composition, being infusible, renders the impregnated material fireproof. No details are given as to method of impregnation.

Book Reviews

Nitrogen—In Peace or War

Review of Some Current Literature of International Significance

BY GRINNELL JONES

THE NITROGEN INDUSTRY. By *J. R. Partington* and *L. H. Parker*. xi + 336 pp., 23 figures and 19 plates. Constable & Co., London, 1922 (D. Van Nostrand, New York, 1923). Price, $6.

THE rapid growth of the nitrogen industry and the great stimulus to research on nitrogen fixation during and since the war have inspired the publication of several new books. A German, B. Waeser, has produced a typical Teutonic handbook, "Die Luftstickstoffindustrie," systematic, detailed, ponderous, but relatively free from critical analysis and comparison of the various processes; essential to the reference library and to the specialist on nitrogen fixation, but a bore to most readers.

Les Mémoires de la Société des Ingénieurs Civils de France (eighth series, vol. 75, pp. 172-342, 1922) contains a series of articles broadly covering the nitrogen industry, chiefly notable for the best available description of the Claude process, written by Claude himself.[1]

The splendid group of American chemists at work in the Fixed Nitrogen Research Laboratory at Washington have published a "Report on the Fixation and Utilization of Nitrogen" (No. 2041, 1922), which contains a detailed description and a critical comparison of the existing processes. This report also contains considerable disclosures of the conclusions reached as a result of the research that has been carried out in this laboratory, but it is not burdened with the details of the experimental proof of the conclusions.

From England we have the "Final Report of the Nitrogen Products Committee to the Ministry of Munitions of War" (1919), together with a later "Statistical Supplement" (1921), which, although weak on the purely technical side, is unique for its systematic compilation of the world statistics of the industry and for its discussion of the competitive strength of the different branches of the nitrogen industry.

[1]For an abstracted translation see *Chem. & Met.*, vol. 28, No. 11, pp. 498-501, March 14, 1923.

"THE NITROGEN INDUSTRY"

From England we have also the volume by Partington and Parker, the primary subject of this review. This book is so profoundly influenced by the earlier British report just referred to that it may almost be regarded as a popularized edition of it, with many good pictures and much more or less superficial technical descriptions added. The authors emphasize the vital importance of nitrogen fixation to Great Britain in war and peace and freely criticize the handling of the situation by British officials and financiers.

The book discusses the Chilean nitrate industry, byproduct ammonia, synthetic ammonia, the cyanamide process, the arc process and the oxidation of ammonia. The chapters dealing with the Chilean nitrate industry and the oxidation of ammonia are the best. Many statistical tables are taken from the earlier British report with little if any effort to bring them down to date. The thermodynamic and kinetic theory of the processes is touched on very lightly. Indeed, the presentation is so simple, clear and superficial that it can be followed by a reader having only the most elementary knowledge of chemistry. Disclosures of information which has not already appeared in the technical press are conspicuously absent. Thus the description of the catalysts for the ammonia synthesis is confined to the following:

> The catalysts are usually mixtures of various substances. Metallic iron is the main constituent, but small amounts of other substances called "promoters" are added. One of these is molybdenum. Uranium may also be used. Very pure

iron, according to Nernst, has a very slight action only. . . . The catalyst was stated to be the same as that used in ammonia oxidation, probably oxide of iron and chromium; it remains active for 2 years.

In view of the fact that the German plants have been visited by British, French and American chemists and that the authors have been members of a British organization which has been active in research work on nitrogen fixation the inference is plain that the authors, if they had desired to do so, could have given a much more detailed and accurate account of the catalysts; of the method of their preparation; their efficiency under various conditions of temperature, pressure and gas velocity; and their sensitiveness to poisons.

This book will be the least valuable to the specialists of any of the new books on nitrogen fixation referred to above. But the book can be fairly judged only with reference to the purpose of the authors—viz., to impress upon the general public the unique position of "the greatest, the most important key industry of all." Judged in the light of this purpose, this book is admirable. It is to be hoped that in America, as well as in Great Britain, it will reach a large public—chemists, newspaper editors, Congressmen, investors, public spirited citizens. Let every chemist buy a copy to lend to his friends and see that a copy is made available in the public library in his home town!

Contrasting Our Position With England's

The American reviewer feels constrained to reply to this criticism of Great Britain by a Briton. If the submarine had actually secured command of the sea, as it so seriously threatened to do in 1917, Great Britain would have been forced to acknowledge defeat through starvation with or without a nitrogen fixation industry at home. It was therefore sound public policy for Great Britain, in the crisis of the war, to concentrate her full resources in steel, labor, and in the brains of her scientific men and inventors to the conquest of the submarine, to the neglect of all other things. Even a well-developed nitrogen industry yielding a large surplus for fertilizer above the military requirements could not make Great Britain independent of imports of food. The submarine was mastered in the nick of time and the policy of the government was thus justified by success.

In the United States, on the other hand, the situation was and remains fundamentally different. In 1917 the possibility had to be faced that the submarine would secure virtual command of the sea. In such a contingency the United States, although denied a definite victory, could at least avoid defeat through invasion as long as the supply of explosives did not cease through lack of nitrates. With an adequate supply of nitrates available from the air, the United States and Canada together could defend themselves against invasion indefinitely even if completely shut off from imports by sea. A failure in the supply of rubber would be embarrassing and of coffee inconvenient, but no imported article, except sodium nitrate, is really essential for the national existence and military defense. This is the reason that the United States in 1917 and 1918 made frantic efforts to secure a supply of nitrates from a source beyond the reach of the submarine, whereas Great Britain postponed the problem until after the war. The lesson of this English book on "The Nitrogen Industry" is thus even more vital to the United States than it is to Great Britain.

Index for Engineers

Catalysis in Organic Chemistry. By York, 1923, The American Society of Mechanical Engineers. 675 pp. Price, $6.

This work, the best yearly index of periodical literature from the engineer's point of view, reaches with this issue its twenty-first volume. Throughout its long record of service the book has year by year become more valuable; its field of action has been made broader by the inclusion of more and more publications among those received, and the presentation, especially with reference to the method of classifying and cross-indexing, has been improved.

The number of publications reviewed now covers fully 1,300, including periodicals, reports and other items. Of these, articles to be indexed have been selected from over 600, of which approximately 50 per cent are foreign publications. The individual references have been written in a much more concise form than formerly, thus permitting an index of greatly increased scope to be published with the addition of but few pages.

G. L. Montgomery.

Important Articles in Current Literature

More than fifty industrial, technical or scientific periodicals and trade papers are reviewed regularly by the staff of *Chem. & Met.* The articles listed below have been selected from these publications because they represent the most conspicuous themes in contemporary literature, and consequently should be of considerable interest to our readers. Those that are of unusual interest will be published later in abstract in this department; but since it is frequently impossible to prepare a satisfactory abstract of an article, this list will enable our readers to keep abreast of current literature and direct their reading to advantage. The magazines reviewed have all been received within a fortnight of our publication date.

Formation, Chemical Constitution and Utilization of Oil. Eugene Grandmongin. The first of a series of reviews on industrial science written for the engineer. *Le Génie Civil*, May 12, 1923, pp. 444-6.

Automatic Regulation of Nitrogen Oxides in the Chamber Process of Sulphuric - Acid Manufacture. Kai Warming. Outline of a proposed system based on temperature differences between chambers. *Chimie et Industrie*, April, 1923, pp. 671-3.

Synthetic Tannins. R. B. Croad. Review of the history, methods of manufacture and use of these products. *J. Soc. Chem. Ind.*, May 11, 1923, pp. 203T-207T.

The Llandarcy Refinery of the Anglo-Persian Co. A semi-technical discussion of the first Anglo-Persian plant to be installed in South Wales. *Chemistry & Industry*, May 18, 1923, pp. 482-6.

The Stream - Line Filter. J. W. Hinchley. A note on a new filter invented by Prof. Hele Shaw. *Chemistry & Industry*, May 18, 1923, p. 489.

Methods of Establishing Wage Rates and Determining Promotions. H. P. Carruth. A reduction of personnel problems to a fixed basis by use of questionnaires and graphic ratings. *Paper Trade Journal*, May 24, 1923, pp. 49-58.

Continuous Digestion of Paper Pulp. Raymond Fournier. A proposed apparatus which makes continuous digestion possible under moderate pressure. *Paper*, May 23, 1923, pp. 5-6.

Leaching of Tannin Materials. J. A. Reavell. Notes on the Thorncroft Patent Leaching Apparatus. *Chemical Age* (London), May 12, 1923, pp. 506-8.

Most Modern Cement Plant in France. J. Prouteau. Poliet & Chausson Plant at Gargenville has most up to date apparatus on all departments. *Rock Products*, May 19, 1923, pp. 11-20.

Coal Carbonization as Applied to Power-Plant Practice. V. Z. Caracristi. The lead bath method of low-temperature carbonization applied in the boiler house. *Power*, May 29, 1923, pp. 831-6.

Fundamentals of Catalysis

Catalysis in Organic Chemistry. By *Paul Sabatier*, translated by *E. Emmet Reid*. 406 pages. D. Van Nostrand Co., New York, 1922. Price, $5.

There is only one reason now why Sabatier's text on catalysis in organic chemistry should be read in the original French. If you are unskilled in the reading of scientific French, Sabatier's book is a good text to study, with its relatively simple language forms, its wide range of scientific words and the general interest of the subject to hold your attention. But Professor Reid's translation is a far more useful text if it is information on the subject of catalysis that you need. It is broader, it is better, more accurate and more detailed than the original, which itself is a classic. So it is not even necessary to say that the book is indispensable. Anyone who takes catalytic work seriously, and most of us ought, would be foolish to be without it.

The book is a detailed record of the contributions of the catalytic investigators to preparative organic chemistry. It is especially concerned with the reactions of hydrogenation and dehydrogenation, hydration and dehydration, those reactions in which the Sabatier researches have been most fruitful, in which the contact catalyst has meant the ready attainment of otherwise difficult ends and in which new processes of the laboratory and the industry have found their origin. As a compendium of such it is invaluable. It has a further value to those who would know what has already been accomplished and who would embark upon the labors of extension and amplification; because, on reading this book, one cannot but be struck with the largely empirical nature of the achievements in contact catalysis. And to some of us there must come a desire to see the empirical make way for the more rational. To do this, however, we must know, thoroughly, the empirical.

It is on the theoretical side that Sabatier's book is weakest. Professor Reid has helped materially to correct this by incorporating a chapter by Professor Bancroft on theories of catalysis. Reading this section, how-

ever, the reviewer feels that a considerable period of time must have elapsed between the receipt of the contribution and the publication of the book. Professor Bancroft's views have already progressed materially beyond the thoughts expressed in the chapter he contributes to this book. In addition to this chapter there are copious signed footnotes by various interested workers in the field in this country which amplify very helpfully the data in the text.

The method of paging is confusing, the numbers being on the inside edge of the page, paragraph numbers occupying the position usually occupied by page numbers. One doubts whether this is wise.

From the graceful biography of Sabatier contributed by the translator the pessimistic research man may take courage. The work which has rendered Sabatier's name illustrious in the annals of his science was all done after 20 years of research work in another branch for which he is practically unknown. HUGH S. TAYLOR.

Men in the Profession

E. E. AYARS, chairman of the refractories division of the American Ceramic Society and recently superintendent of the silica brick plant of the American Refractories Co., at Joliet, Ill., has severed his connection as a result of the change in management of this plant. Mr. Ayars had been in the employ of the American Refractories Co. in various capacities in the operating department for 5½ years.

MARION G. BRYCE, president of the United States Glass Co., Pittsburgh, Pa., was tendered a testimonial dinner by stockholders in the company at the William Penn Hotel, May 22. Ernest Nickel, treasurer of the company, acted as toastmaster.

H. V. BURGARD, consulting metallurgist, of Hollywood, Calif., has returned from an extended trip in Arizona and Nevada on professional business.

J. V. N. DORR has been made an honorary member of the Phi Lamda Upsilon scholastic chemical fraternity.

R. C. HARTONG, formerly chief chemist at the plant of the Goodyear Tire & Rubber Co., of Akron, Ohio, has been elected president and treasurer of the Chemitex Products Co., recently organized to establish a plant at Mogadore, near Akron.

Dr. VICTOR F. HESS, chief physicist of the U. S. Radium Corporation, has resigned to assume the chair of experimental physics at the University of Graz, in Austria.

Dr. GUSTAVE E. LANDT has resigned his position on the teaching staff of Columbia University to engage in research and development work with the Agosote Millboard Co., Trenton, N. J.

D. S. MCAFEE, of the Dorr Co., was recently in San Francisco.

JOSEPH MCAULIFFE has resigned as mill superintendent of the Caribou Metals Co. to devote his entire time to the Mace Co. G. G. GENTRY has succeeded Mr. McAuliffe as mill superintendent of the Caribou Metals Co.

E. B. MILLER, vice-president of the Davison Chemical Co., Baltimore, Md., addressed a meeting, held under the auspices of the local sections of the American Society of Mechanical Engineers and the American Chemical Society, at Baltimore, on May 25. His address was on "The Refining and Recovery of Petroleum Oils by Silica Gel."

GEORGE K. MORROW has been elected president of the American Cotton Oil Co., New York, succeeding Lyman N. Hine. Mr. Hine will become vice-president and devote a portion of his time to the affairs of the company.

F. N. RHODES, assistant works manager for the Wilson Portland Cement Co., Ltd., of Auckland, New Zealand, was in San Francisco recently and visited nearby cement plants.

Dr. E. E. SLOSSON is en route to Sweden to be a guest, along with a small group of journalists, of the municipality of Gothenburg at its tricentennial.

Obituary

JOHN VAN VORST BOORAEM, aged 86, for half a century a prominent engineer in the sugar-refining industry, died on May 24 at his home in Brooklyn, N. Y., after a brief illness. As a young man Mr. Booraem studied engineering for 5 years in France and Germany. In 1861 he was engaged as a marine engineer for the government. From 1870 to 1882 he was connected with the Decastro & Donner Sugar Refining Co. and from 1882 until 1898 he was consulting engineer for the American Sugar Refining Co.

WILLIAM D. FRERICHS, a pioneer in the terra cotta industry and one of the organizers of the Atlantic Terra Cotta Co., New York, died at his residence on Amboy Road, Tottenville, Staten Island, May 17, aged 77 years. He entered the employ of the Perth Amboy Terra Cotta Co., Perth Amboy, N. J., about the time that this company was formed, in 1877, then the only company in America devoted to this line of manufacture. Following a reorganization of the Atlantic Terra Cotta Co. several years ago, Mr. Frerichs resigned and became affiliated with the Federal Terra Cotta Co., Woodbridge, N. J.

Dr. HANS GOLDSCHMIDT, inventor of the "thermit" reaction between metallic oxides and powdered aluminum, now widely used as a process for welding steel and for producing some of the less common metals and alloys, and the originator of many other scientific inventions, died suddenly in Baden-Baden, Germany, on May 20, 1923. Professor Goldschmidt was born in Berlin in 1861. His father was the proprietor of chemical works and tin smelters which he had founded in 1847. Hans Goldschmidt studied at the universities of Berlin, Leipzig, Heidelberg, Strassburg and at the Institute of Technology at Charlottenburg, receiving the degree of Ph.D. from the University of Heidelberg in 1886. In 1887 Goldschmidt entered the firm of Th. Goldschmidt, Essen Ruhr, Germany, in joint partnership with his brother. The attention of the latter was applied mainly to the business management of the company, while Hans devoted himself to scientific research. Under their joint guidance the firm grew rapidly in importance. Professor Goldschmidt visited this country very frequently in the years before the war, to supervise his interests in the Goldschmidt Thermit Co. (now the Metal & Thermit Corporation). Through his death the world loses a chemist of great knowledge and inventive genius.

Calendar

AMERICAN ASSOCIATION OF CEREAL CHEMISTS, ninth annual convention, Hotel Sherman, Chicago, June 4 to 9.

AMERICAN CHEMICAL SOCIETY, fall meeting, Milwaukee, Wis., Sept. 10 to 14.

AMERICAN CHEMICAL SOCIETY, New York Section, regular meeting, Rumford Hall, Chemists' Club, June 8.

AMERICAN ELECTROCHEMICAL SOCIETY, forty-fourth meeting, Dayton, Ohio, Sept. 27 to 29 (dates provisional).

AMERICAN ELECTROPLATERS SOCIETY, eleventh annual meeting, Providence, R. I., July 2 to 5.

AMERICAN GAS ASSOCIATION, annual convention, Atlantic City, Oct. 15 to 20.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, summer meeting, Wilmington, Del., June 20 to 23.

AMERICAN LEATHER CHEMISTS ASSOCIATION, twentieth annual convention, Greenbrier, White Sulphur Springs, W. Va., June 7, 8 and 9.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS, iron and steel exposition, Buffalo, N. Y., Sept. 24 to 28.

AMERICAN SOCIETY FOR TESTING MATERIALS, twenty-sixth annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, June 25 to 30.

INSTITUTE OF MARGARIN MANUFACTURERS, fourth annual convention, Hotel Traymore, Atlantic City, June 14 and 15.

NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES (NINTH), New York, Sept. 17-22.

NATIONAL FERTILIZER ASSOCIATION, thirtieth annual convention, White Sulphur Springs, W. Va., June 11 to 16.

NATIONAL LIME ASSOCIATION, fifth annual convention, Hotel Commodore, New York City, June 13 to 15.

SOCIETY FOR STEEL TREATING, Eastern sectional meeting, Bethlehem, Pa., June 14 and 15.

TAYLOR SOCIETY, Hotel Onondaga, Syracuse, N. Y., June 7 to 9.

Industry and Trade

Current News and Market Developments

Summary of the Week

The Geological Survey reports material increases in production of lead and zinc pigments for 1922.

German producers of chemicals and dyes are reported to be considering establishment of plants in the United States.

Official customs returns show that exports of chemicals and allied products for April were valued at about the same totals as those for March.

Standards of strengths for coal-tar products are expected to be announced very soon. They will form a basis for levying duties on imports.

Advices from Germany state that there is a scarcity of caustic soda in that country.

Imported chemicals are held in large amounts in the spot market and prices are being shaded on many selections.

The lower selling prices for gasoline have brought out an easier situation in motor benzol.

The shortage of arsenic, which was predicted earlier in the season, has not stimulated buying and prices are working lower.

Prices for future positions of linseed oil are considerably under spot prices, reflecting an easier market for seed.

Copper sulphate of foreign make is steadily declining in price with considerable stocks to be worked off.

As a result of the recent conference of the American States, trademarks of this country may be recognized in South American countries.

A committee has investigated conditions in the customs service at New York and made suggestions to expedite the passage of imported goods to the consignees.

The Tariff Commission is reported to have under consideration a plan to compile its own figures on imports and exports, independent of the Commerce Department.

Resale lots of phenol sold at 45c. per lb., which is a drop of 10c. per lb. from the recent high.

The U. S. Treasury is seeking $40,000 as duty charges against the cargo of German dyestuffs brought in on the submarine "Deutschland."

A decrease in the April wholesale trade of 9 per cent from the March record was announced by the Federal Reserve Board.

Electrochemical interests are negotiating for water power rights in North Carolina and Tennessee.

French chemist claims to have devised process whereby coal can be dissolved.

The daily average production of petroleum in April increased to the high record of 1,937,767 bbl.

Some round lots of cyanide of soda changed hands, with imported bringing 20c. per lb.

Germany Striving to Preserve Its Chemical Industry

Intensive Efforts to Maintain Manufacture on Large Scale—Relief From Export Taxes Asked—Lower Freight Rates and Reduced Coal Prices Demanded—Establishment of Plants in United States Considered

GERMANY is more anxious to preserve its chemical industry than any other activity within its boundaries. Latest advices from that country indicate that intensive efforts to that end are being exerted. The Germans would rather maintain their chemical industry than even the manufacture of iron and steel, despite the success which always has attended their operation of metallurgical plants.

The principal reason for the desire to make the chemical industries Germany's greatest industrial endeavor is the fact that it uses German raw materials almost exclusively. It provides more labor for Germans and presents a field in which the Germans believes they are particularly skilled.

To this end the German chemical manufacturers are demanding relief from export taxes. In addition, they are asking special reductions in the matter of freight rates and coal prices. It is contended that all other industries can afford to contribute something to the effort to restore the chemical industry to its former pre-eminence.

It is known that the Aniline Cartel is only awaiting the agreement on reparations to begin a very active campaign. The cartel is more concerned because of the loss of American business than over any other development of the post-war period. The fact that American dye manufacturers now are furnishing 93 per cent of all dyes used in the United States is a severe blow to the cartel. The successful production of blue indanthrene in America has convinced the German chemists that the American industry soon will attain as high efficiency as ever was reached in Germany.

Serious consideration is still being given to the establishment of large plants in the United States. Once that the reparation matter is settled, it is believed that Carl von Weinberg will make the long-promised survey of the American situation. Apparently there is a widely held belief that the interests of the Bädische can be forwarded by the establishment of plants in the United States.

It is known that most of the French dye manufacturers believe their interests would be served best by effecting a close working agreement with the Bädische. There is every reason to believe that the progress already made in that direction will continue.

April Exports of Chemicals Practically of Same Volume as March Shipments

Soda and Fertilizer Groups Show Increase—Outward Movement of Explosives Displays Decided Slump

EXPORTS of chemicals and allied products in April continued in practically the same volume as during March. In the grand total there was a difference of $360,000 in favor of March, but there were several instances of decided increases among the chemicals proper. Both the soda and fertilizer groups showed increases over March. The value of April exports was at a rate nearly $2,000,000 in excess of the rate of the chemical exports in April, 1922.

Sodas and sodium compounds to the extent of 36,605,402 lb. were exported in April. The value of pigments, paints and varnishes exported in April was about $200,000 less than in March, but still is decidedly ahead of the rate of exportation in April of 1922.

Fertilizers and fertilizer materials to the extent of 98,236 tons were exported in April. This compares with 89,519 tons in March and 87,161 tons in April of 1922. The increase applied as well to sulphate of ammonia. The April exports of that commodity amounted to 15,670 tons, as compared with 12,951 tons in March and 12,743 tons in April, 1922. The heavy movement of this commodity to Spain has ceased entirely, but shipments in greater volume are moving to the Orient.

One of the big slumps of the month was in the explosives group. In March 3,254,747 lb. of explosives was exported. This fell to 1,744,405 in April.

Certain of the individual items in which decided changes in movement are taking place are as follows:

	April, 1922	April, 1923
Quinine, oz.	9,102	22,038
Sulphuric acid, lb.	1,991,368	368,586
Wood and denatured alcohol, gal.	62,579	81,085
Ammonia and ammonium compounds, lb.	281,817	562,594
Calcium carbide, lb.	1,559,138	407,658
Bleaching powder, lb.	2,788,056	659,335
Copper sulphate, lb.	917,495	47,010
Cyanide of soda, lb.	180,070	447,773
Borax, lb.	1,625,025	4,217,604
Caustic soda, lb.	15,017,777	12,284,777

The figures are those of the Department of Commerce. They have just been compiled from the returns from the forty-eight customs districts in the United States.

Sigurd Dyrup on European Trip

Sigurd Dyrup, formerly of Copenhagen, Denmark, now technical director of the Cook Paint & Varnish Co., Kansas City, Mo., has sailed for a couple of months' trip abroad, checking up latest developments in the paint and varnish industry. While abroad, Mr. Dyrup will visit the plants manufacturing some of the most important basic commodities. He will return to this country in time to supervise arrangement and installation of new mechanical and chemical apparatus in Cook's new factory, which will be completed by that time.

A farewell dinner was given Mr. Dyrup previous to his departure, at which Charles R. Cook, president of the Cook Paint & Varnish Co., presented him with a sapphire and diamond scarf pin.

Vigorous Activity in California Cement Industry

Expansion in the hydro-electric power industry in the West is largely responsible for a considerable spurt in the production of cement in California. The Santa Cruz Portland Cement Co. is doubling the capacity of its plant at Davenport, Santa Cruz county, and will soon be in a position to put out 10,000 bbl. per day. A new corporation, headed by John F. Humberg, vice-president of the Engels Copper Mining Co., has been formed to utilize the cement material in the quarries of the Three Rivers district and to erect a plant, to cost about $4,000,000, about 6 miles from Exeter, Tulare county. The Monolith Portland Cement Co. is enlarging its plant at Monolith, Kern county, and plans to be in a position to supply 6,000 bbl. per day by the end of 1923.

Deutschland Duties Dispute Focused in Baltimore

The wheels of time grind slowly. The U. S. Treasury is now seeking $40,000 of duties claimed on the cargo of the submarine "Deutschland." Circuit Court Judge Rose is hearing the case. A. Schumacher & Co., consignees of the cargo, admit that $10,000 is due. District Attorney Woodcock, conducting the government's side in the proceedings, said the dyestuffs cost $332,000 when bought in Germany. The freight charges on the cargo, Mr. Woodcock said, were $998,000. The government contends that a part of this sum really was part of the purchase price for the dyestuffs and should be included in the duty charges.

London Tallow Auction

At the weekly London tallow auction held May 30, the offerings consisted of 1,524 casks. Sales reached 480 casks and prices realized were 9 pence lower.

Electric Founders Continue Research Activities

The Electric Steel Founders' Research Group held a regular meeting of executives of the five electric steel foundries conducting co-operative research work, at Wernersville, Pa., May 14 to 17. The various phases of the research work being done by the members of the group to improve the quality of steel castings and increase efficiency in methods were discussed in detail. Formal reports giving the status of the present research investigations were read on such subjects as facing sand mixtures, core sand mixtures, electric furnace practice, heat-treatment of steel castings, production control and porosity in castings.

At this meeting plans were made for conducting research investigations on additional steel foundry problems. The results obtained from the work done so far have been so beneficial as to make it highly desirable to study intensively some of the additional complex problems involved in making thin section electric steel castings of intricate design.

Plans for Paper and Pulp Research Announced

During the coming year the Technical Association of the Pulp and Paper Industry proposes to carry on the work of research which has been undertaken during the past few years. The general standing committee covering the manuturing processes—mechanical, sulphite, sulphate and soda pulp—will continue its investigation of proposed modifications and of the use of newly developed apparatus, at the same time fostering improvements in efficiency and the establishment of standard practice.

Among the subjects of research will be gum and wax papers, the development of special test methods for special products, and research on drying of paper and pulp products. The work of the waste committee on white water losses and on heat losses throughout the mill will be carried on vigorously. As an aid in cellulose research, it is intended to co-operate with the Cellulose Division of the A.C.S.

Power Developments Proposed for South

Electrochemical and electrometallurgical interests are negotiating for water-power rights on the Pigeon, Clinch, Powell and Holston rivers in western North Carolina and eastern Tennessee. It is believed that the water powers on the western slope of the southern Appalachian range can be developed as successfully as has been done by the Southern Power Co. on the eastern slope. Incidentally, this plan is meeting with opposition from those most interested in Muscle Shoals development, who would like to see these industries locate at that point.

American Cotton Oil to Be Reorganized

A short time ago reports were current to the effect that the American Cotton Oil Co. was to be merged with other cotton oil concerns. Either these reports were not based on facts or negotiations did not work out successfully, as no merger has been made and denials of any contemplated merger came from parties directly mentioned as principals. It is now unofficially reported that plans for reorganizing and recapitalizing the company are being worked out by the officials and directors.

Capital consists of $14,562,300 authorized 6 per cent non-cumulative preferred stock, of which $10,198,600 is outstanding, and $20,237,100 common authorized and outstanding. Funded debt totals $13,500,000, of which $5,000,000 is 20-year 5 per cent bonds due in 1931 which while a direct obligation are not a mortgage. The rest of the funded debt consists of $8,500,000 5-year 6 per cent notes due September, 1924, originally $10,000,000 dated September 10. Under terms of the indenture company agreed to retire $500,000 annually.

Phosphate Rock Shipments in 1922

According to the Department of the Interior, 2,417,883 tons of phosphate rock valued at $10,828,346, was shipped from mines in the United States during 1922, as shown by statistics collected by the Geological Survey. Florida, the leading state, shipped 2,058,593 tons, worth $8,347,522, more than nine-tenths of which was land-pebble phosphate. From Tennessee, 353,309 tons, worth $2,107,382, was reported, including a comparatively small quantity from Kentucky, most of which was brown rock. Small shipments were reported from Idaho and South Carolina.

Electro-Metals Planning California Development

Important developments in electrometallurgy in California are presaged by the announcement that plans have been proposed for the construction of a dam at Ishi Pishi Falls, on Klamath River, at the base of which a 110,000-hp. hydroelectric plant will be erected. This project, sponsored by the Electro-Metals Co., is preliminary to the manufacture and distribution of electrometallurgical products at a point on the Californian seaboard.

The Electro-Metals Co. is equipped to carry the project to a successful technical and business conclusion. Officials include Bulkeley Wells, vice-president and managing director of the Metals Exploration Co.; W. W. Crocker, vice-president of the Crocker National Bank of San Francisco, and William Braden, former president of the Braden Copper Co., of New York. Frank Langford, mining and electrochemical engineer, has made a study of plants and processes in operation in France, Germany, Switzerland and Scotland, and has visited the bauxite deposits of France and Italy, as well as other potential deposits in Ceylon and India. The result is that sufficient data are available to indicate that ore could be delivered at Trinidad or Eureka, Calif., at a lower cost than would be incurred by a railroad haul of a few hundred miles. Construction work on the new dam is expected to commence when the necessary government and state permits have been issued.

Corrosion Data Available in the Near Future

The Chemical Warfare Service's data on the corrosion of metals and materials by acids and alkalis is likely to be available within a few weeks. Major Gibson, speaking for this branch of the service, says:

"This compilation is not being issued by the Chemical Warfare Service, due to the fact that it is desired that those scientists who contributed important parts to the compilation may have full credit for the same, and may be able to present the results of their work before scientific societies, and have published under their respective signatures the papers embodying the data for which each is responsible.

"Papers by Messrs. Calcott and Whetzel, together with a paper by Mr. Whittaker, will be published by the American Institute of Chemical Engineers as a monograph on corrosion. This monograph should cover the essentials of the Chemical Warfare compilation on this subject."

Zinc Institute Seeks Co-operation of Galvanizers

The steps taken at the St. Louis meeting of the American Zinc Institute looking to closer co-operation with the galvanizers are regarded by H. Foster Bain, director of the U. S. Bureau of Mines, as one of the most important outcomes of the meeting. Heretofore the galvanizers have believed that the zinc industry has had little concern for their problems. Now that the Zinc Institute has taken the initiative looking to close co-operation, it is believed that much can be accomplished toward overcoming difficulties that are harmful alike to the zinc industry and to the galvanizers. Each is interested, Mr. Bain believes, in improving the quality of galvanized sheets.

Since the change from iron to steel, galvanized sheets have gradually lost much of the good reputation they once had, Mr. Bain points out. This is due to the fact that a different and a more difficult technical process must be employed. He believes the technology in galvanizing steel sheets can be brought to the same plane of efficiency as was obtained with the use of iron sheets. By the production of a better product, it will be possible, he believes, to increase very greatly the domestic market for zinc.

Stamford Chemists Dine

About forty-five members and guests of the Stamford Chemical Society gathered at the annual banquet on Monday, May 28. Retiring President Stevens outlined the work done during the past year and asked Dr. Getman to tell the visitors of the prizes the society has offered to the high school students in Stamford for essays on chemical subjects. President-elect H. W. Banks then introduced Charles Wadsworth, assistant editor of *Chem. & Met.*, as toastmaster. Addresses were made by Schuyler Merritt, Representative in Congress from the Stamford district, and by Harrison E. Howe of the American Chemical Society.

April Petroleum Output Is Greater Than Consumption

During April, according to the statistics of the Geological Survey, the daily average production of petroleum increased to the high record of 1,937,-767 bbl. Daily average imports of crude petroleum, as reported to the Survey by importers (165,500 bbl.), decreased 22,887 bbl.; daily average consumption (1,856,900 bbl.), as indicated by deliveries to consumers, decreased slightly, with the result that for the first time since April, 1922, domestic production of crude petroleum was greater than consumption plus exports of domestic and imported crude petroleum.

Pipe line and tank line stocks of crude petroleum increased 5,889,000 bbl. during the month.

New Yellow Dye Is Produced in U. S.

E. I. du Pont de Nemours & Co. announce the development of an important acid yellow dye, especially noted for its excellent resistance to light, being one of the fastest acid yellows in this respect. The new color is known as Pontacyl Light Yellow 3G, and on account of its good solubility and bright clear shade is an important color for lakes, being well adapted for use in the manufacture of printing and lithographic inks. On paper, it is suitable for dipping, coating and calender coloring.

This dye is one of those which has been imported in important quantities from Europe, and its development here makes it available for American manufacturers as a native color.

Drop in Wholesale Trade

A decrease in the April wholesale trade of 9 per cent from the March record was announced by the Federal Reserve Board last Thursday. The board attributed the loss to seasonal causes and reported that it was not indicative of any serious economic condition. The sales for April this year are 17 per cent greater than those for April, 1922. The greatest sales decreases were in jewelry, shoes, dry goods, clothing and diamonds.

Washington News

Standards for Coal Tars to Be Issued This Month

The Treasury Department expects to issue early in June its official list of standards of strengths of coal-tar dyes and chemicals which is to be the basis of assessment of duty on imports.

A tentative list, specifying approximately 100 dyes, was drawn up a month ago and copies were sent to importers and domestic producers for criticism and suggestion. Copies of the replies have been submitted for study to collectors and appraisers at the leading ports, especially at New York, where more than 95 per cent of the coal-tar products are entered and where the chemical laboratory of the Customs Division is located. Those suggestions which appear to improve the tentative list will be incorporated in the final draft.

The 1922 tariff act provides that coal-tar products be assessed for customs duty according to the weakest strength of similar products imported in commercial quantities prior to July 1, 1914, as many such products now are being imported in stronger concentrations. The list of so-called standards of strength is being compiled for this purpose.

Drawback Allowed on Refined Soya Bean Oil

The customs service of the Treasury Department granted an import drawback last week on refined soya bean oil and soap stock manufactured by the Portsmouth Cotton Oil Refining Corporation, of Portsmouth, Va., from imported crude soya bean oil, the regulations being amended to provide that the manufacturing record and abstract therefrom should show the value of the refined soya bean oil obtained instead of the value of the imported crude soya bean oil used.

Shortage of Caustic Soda in Germany

A new period of shortage of caustic soda in Germany seems to have set in. The Russians and Austrians appear to be willing to pay more for this commodity than domestic buyers in Germany are willing to pay. In turn the Germans are reluctant to buy abroad in the face of the present currency situation.

Services of Chemists in Demand

Practically no unemployment among chemists exists, reports to Washington indicate. Not only are the services of competent chemists in great demand, but the sum of salaries and compensation being paid chemists exceeds by far any previous total ever paid in the history of the American chemical industry.

Tariff Board May Compile Import and Export Statistics

The Tariff Commission has had under consideration the advisability of collecting its own reports on the monthly imports and exports. It is held that by such procedure the totals for our foreign trade would be more readily available to the commission and changes in tariff schedules might be made more promptly in cases where developments would make such changes necessary. This work would be independent of the Commerce Department and would require expansion in the New York office to handle the collection of import and export figures.

Trademark Agreement With South America

Henry P. Fletcher, Ambassador to Belgium, has returned from the conference of American states recently held at Santiago. Mr. Fletcher stated that at the conference an agreement had been reached whereby a United States trademark registered at Montevideo, Uruguay, or at Havana, Cuba, may secure recognition in all of the South American states.

Canada May Appoint Customs Official at New York

A report from Ottawa states that the Minister of Commons has informed the members of the House that the appointment of a Canadian customs officer at New York is still under consideration. The question arose on a discussion of the all-water route from Canadian eastern ports to Vancouver, via the Panama Canal. A Canadian customs officer, it was pointed out, would be needed to supervise transshipment of cargoes broken in bulk at New York.

Tariff Commission Reports to Be Ready This Month

The Tariff Commission has notified the President that reports covering surveys undertaken by the commission to determine the necessity for investigations into different commodities for the purpose of adjusting duties will be completed by the latter part of the month. The report on one commodity is said to be ready now. It is the intention of the commission to take action upon four or five other commodities and to forward reports of its preliminary surveys as completed.

Increased Arsenic Production in Canada

Increasing amounts of white arsenic are being produced at the silver mines of northern Ontario. The fact that the arsenic is bringing high prices has resulted in no little stimulation to the production, it is stated.

Gains in Output of Lead and Zinc Pigments

From figures compiled by the Geological Survey, it is evident that substantial increases in production were made in the cases of lead and zinc pigments in 1922. The figures as issued give totals marketed rather than produced but are relatively true in either case as an index of larger supplies.

Notable increases were made in the sales of all zinc pigments and salts except zinc chloride, but there was a falling off in the average price per ton. The largest output of zinc oxide made in the history of the industry was recorded, the gain amounting to 73 per cent over the output in 1921. The amounts marketed were as follows:

	1921		1922	
	Short Tons	Value Per Ton	Short Tons	Value Per Ton
Sublimed lead*				
White	11,568	$122.61	13,765	$132.94
Blue	463	126.55	972	132.95
Red lead	21,814	156.36	30,509	167.30
Orange mineral	379	240.59	370	224.38
Litharge	41,953	136.84	58,261	152.63
White lead:				
Dry	26,695	140.47	41,598	139.07
In oil	143,634	192.94	153,393	193.80
Zinc oxide	74,329	151.11	128,465	140.07
Leaded zinc oxide	16,103	129.93	19,613	114.80
Lithopone	55,016	121.45	83,360	110.53
Zinc chloride	59,457	59.75	41,627	48.27
Zinc sulphate	3,295	57.47	5,078	49.53

* Includes basic sulphate lead.

Cease and Desist Order Against Philadelphia Company

The Federal Trade Commission has issued its order against Dudley D. Gessler, Philadelphia, Pa., who sells dyestuffs and chemicals under his own name as well as under the name of the Keystone Chemical Co. The Commission's order reads as follows: That respondent, Dudley D. Gessler, and his agents, cease and desist from, directly or indirectly, giving or offering to give to superintendents, foremen or other employees or representatives of customers or prospective customers without the knowledge or consent of their employers, cash commissions, sums of money or other things of value, in order to induce such employees or representatives to purchase, on behalf of their employers, the products of respondent or to recommend such purchase to their employers, or as promised rewards for having induced such purchase by their employers.

Surcharge Rates for Duties Paid in Spanish Currency

Assistant Secretary of the Treasury Moss has issued to collectors of customs the currency conversion values for computing countervailing duties on materials from Spain, imported during the first quarter of the year. The rates of surcharge for duties paid in Spanish silver coins or notes of the Bank of Spain were, for the months indicated, as follows: January, 23.79 per cent; February, 23.39 per cent; March, 23.29 per cent, and April, 24.62 per cent.

Committee Investigates Customs Service at Port of New York

Suggestions for Prompter Release of Goods From Government Custody—Importers Protested Against Delays—Congestion at Appraiser's Stores Has Been Relieved

ERNEST W. CAMP, director of the customs service, was head of a special committee recently appointed to make an investigation of conditions in the various departments of the customs service at the port of New York. This committee was an outgrowth of protests lodged by importers who claimed that serious delays were encountered in securing delivery of goods after the latter had reached the local port. Assistant Secretary of the Treasury Moss accordingly appointed a committee headed by Mr. Camp to analyze the situation and recommend plans for improving the customs service and expediting the movement of goods to consignees.

The committee completed its investigation a week ago and while no public announcement of the finding of the committee has been made, it is said that the report offers several suggestions for the betterment of customs service. The increase in imports undoubtedly has had something to do with the delays in passing goods through the customs service and the new tariff law with its provisions for valuations and ad valorem duties also has slowed up the work of officials, especially in the Appraiser's Stores. It is not expected that the situation will be aided by any additions to the present force, as funds are lacking, but practical suggestions for simplifying the handling of goods through the various departments are expected to be followed by good results. Incidentally it is stated that work in the Appraiser's Stores, where the greatest cause of delay existed, has been arranged so that the period of congestion has passed and fairly prompt deliveries of goods through the customs service are now being made.

Trade Notes

Ralph Black, formerly with E. I. du Pont de Nemours & Co., has joined the sales department of The Kalbfleisch Corporation.

A report from Melbourne states that olive oil guaranteed to be the pure product of olives, made in Mildura, is now obtainable in Victoria, Australia.

Erdoel U. Kohlewertung and Dr. Franz Zernik of Berlin, Germany, have perfected a process for manufacturing an odorless soap from naphthene acid.

The Belgian linoleum industry manufactures almost exclusively for domestic consumption, there being less than 50 metric tons exported during 1922. Production is limited to medium and low grades, while high grades of linoleum are imported. During 1922 Belgium imported 3,675 metric tons, valued at 14,231,775 francs.

The Roessler & Hasslacher Chemical Co., New York, with plant at Perth Amboy, N. J., has presented a claim of $708,864.02 against the German Government for damages sustained during the war.

Sales of pumice stone in this country in 1922 amounted to 50,047 short tons, which compares with 37,108 short tons in 1921.

The annual consumption of casein in Japan is estimated at 500 tons, most of which is imported from Australia. Due to a shortage in Australia this year, casein has been increasing in price. At present it is 0.60 yen per pound. Casein is used by the Japanese in the manufacture of art paper.

The Hercules Silica Asphalt Co. has been organized at Sheffield, Ala. The company owns extensive asphalt deposits near Sheffield.

J. L. Boisse has been designated as the New York City representative of the Hermitite Chemical Corporation. The corporation is organized under the laws of Delaware with an authorized capital stock issue of $1,000,000.

Thomas C. Craven, president of the Cumberland Chemical Co., 47 West St., New York, has been indicted by the Federal Grand Jury on charges of conspiring to defraud the government through violation of the Volstead law.

E. A. Brand, secretary of the Tanners' Council of America, has been elected president of the New York Society of Trade Secretaries. Mr. Brand has been prominent in trade association work for a number of years. Prior to directing the work of the Tanners' Council he was engaged in foreign trade promotion work for the government.

J. V. Finamore has organized the Paterson Dyestuff & Chemical Co., with headquarters at 134 Sheridan Ave., Paterson, N. J.

Complaints against several prominent oil companies charging them with forcing their customers into using exclusively their own oil tanks and equipment have just been dismissed by the Federal Trade Commission.

Edward Mallinckrodt, of St. Louis, has given $500,000 to Harvard University for a chemical laboratory.

News Notes

French occupation of the Ruhr now shows a net expense of nearly 10,000,000 francs below receipts. To what extent this favorable balance is due to dyestuff seizures is not revealed.

Improved transportation of newsprint is about to make possible a printed sheet in New York 3 days after the paper is manufactured in the woods of Canada. With available stocks both at the mills and in the publishers' warehouses extremely low, this fast freight service is expected to fill a real need.

The Western New York section of the American Chemical Society held its annual meeting at Canisius College on May 29. W. H. Watkins addressed the meeting and the scientific moving picture "The Einstein Theory of Relativity" was shown.

Sixty-five students in the mining engineering college, University of Pittsburgh, Pittsburgh, Pa., are taking a month's training in field work under the direction of Professors Henry Leighton and R. A. Sommers. Trips of inspection are being made to a number of metallurgical plants.

The Willard Gibbs medal was awarded Prof. Julius Stieglitz, University of Chicago, at a meeting held May 28. The presentation was made by Mr. Converse, founder of the prize. Professor Stieglitz spoke on "The Theory of Color Production in Dyes."

Simplification of asphalt varieties from 102 to 13 was decided on at a conference of producers and consumers held recently in Washington. It was decided that the eighty-eight varieties of asphalt used for paving purposes could be reduced to nine, and the fourteen varieties used as brick and stone block fillers could be cut to four.

The Appropriation Committee of the State Legislature, Austin, Tex., is considering an appropriation of $1,526,500 for a College of Mines and Metallurgy. A like fund is to be granted during the second year, or a total of $3,053,000.

The Engineering Section of the National Council will hold its second meeting of the year at Detroit, Mich., in co-operation with the Detroit Safety Council on June 12. Problems of safety in welding and cutting by various methods will be discussed. Industrial sanitation, especially with reference to prevention of infection due to use of cutting oils, will likewise be taken up.

The New York Chapter of the American Institute of Chemistry held its monthly meeting at Mucci's, New York, on May 28. Problems of membership and publicity furnished the topic for the evening's discussion.

Advices from Washington state that customs receipts for the fiscal year up to the last week of May passed the half billion dollar mark and set a record for government revenues from this source.

Development of Sources of Supply for Mangrove Bark and Extract

Bark Found on All Tropical Islands—Manufacture of Extract in Producing Countries Not Sufficiently Developed

A VERY comprehensive report on mangrove bark and extract, with especial reference to sources of supply, has been made by H. M. Hoar, of the Research Division of the Department of Commerce. The report says that mangrove extends as far north and south as the twenty-ninth parallel. It forms a dense growth in patches on the low coasts of all tropical islands. In the United States it occurs along the shores of southern Florida, at the mouth of the Mississippi River and on the coast of Texas. The low coast marshes of Porto Rico produce abundant supplies of mangrove, but, while used locally for both its wood and its bark, the industry has not yet reached an export basis. Mangrove barks constitute the greatest single source of tannin in the Philippines. Analyses prove Philippine barks as rich in tannin content as those used in the cutch factories of Borneo—in fact, the same species of mangrove are common to both regions. Notwithstanding the abundance of mangrove in the Philippines, there are no cutch factories, although the swamp area of one bay in Mindanao covers 25,000 hectares, which, estimating 25 tons of bark to the hectare, would yield a total of 625,000 tons of bark. With a 20-year rotation this should be sufficient to supply a large factory indefinitely. Foreign markets for the bark have not been developed.

Germany Formerly a Large Importer

Prior to the war Germany was active in the exploitation of mangrove bark as a tanning agent. Its main source of supply was East Africa, whose barks seem to be richer in tannin than those of the East Indies. In the former German protectorate the bark was most carefully stripped from the living tree (stripped trees are said to renew their bark in four to six months) under the supervision of the forest department and prepared for export. The export of bark containing less than 45 per cent of tannin was prohibited.

Madagascar exported 21,938 metric tons of mangrove bark in 1913, the greater proportion of which was taken by Germany. In 1917 its exports totaled only 3,410 tons. This decrease was due largely to lack of transportation facilities. Post-war exports, however, have not yet reached the 1913 level. While West Africa has extensive mangrove swamps, no serious attempt at bark collection has yet been made, except in British West Africa, where the industry is well established. Some years ago bark collection was started in Senegal by a French company, which allowed the trees to be cut down without making provisions for replanting, with the result that rapid erosion of the foreshore took place. The government prohibited further exploitation by that company. Stocks of mangrove bark in Burma were practically exhausted in 1919. The problem of working important areas of mangroves in the Andaman Islands is receiving the serious consideration of the authorities.

Manufacture of Extract

The manufacture of extract in the principal countries producing mangrove bark has not been as effectively developed as that of quebracho extract in Argentina and Paraguay. If, however, the industry could be promoted in those countries possessing abundant supplies of mangrove, not only the poorer grades of bark could be utilized but also the leaves, which contain considerable tannin. The leaves are rarely exported, owing to deterioration during transportation. To avoid certain unfavorable chemical changes which the bark undergoes within 48 hours after cutting, it is considered essential to work it up as soon as possible. For this reason the factory should be located in or near the mangrove area. It requires 4 to 6 tons of bark to produce 2 or 2½ tons of cutch. The elimination of waste, greater convenience for shipment and saving in transportation costs should make for further expansion in this industry.

In Dutch and British Borneo the manufacture of extract has become an industry of great importance. The principal factories are located at Pontianak, Rejang, Brunei, Kudat and Sandakan. The latter two are under Scotch control. In 1919 the Netherland Indies exported 3,547 metric tons of mangrove cutch, against 805 tons in 1918.

The extraction of tannin from mangrove bark is a well-organized industry of East Africa. The interest which that region takes in its expansion is manifested in two recent concessions for exploitation of mangrove forests in Portuguese East Africa and Madagascar, both of which contain provisions making it obligatory on the concessionnaires to inaugurate tannin-extract factories within certain specified periods of time. Statistics of exports of this product from East Africa are not available.

The activity of the tannin-extract industry in Colombia was evidenced by its exports to the United States of 2,075,991 lb. of mangrove extract in 1914, the only year for which statistics are obtainable. The principal factories are located at Cartagena and Sinu, each of which has an annual productive capacity of 3,000 tons. With, however, a world-wide reduction in industrial activities during the period of post-war depression, mangrove-extract production in Colombia has been greatly diminished. Both Venezuela and Brazil manufacture mangrove extract for local consumption.

Tannin Content of Mangrove Extract

Mangrove extract is imported in large blocks of a reddish-brown color and has a tannin content ranging from 48 to 72 per cent, according to country of origin. The higher grades come from East Africa and Borneo. Used alone, this extract yields a good, pliant, workable leather, but of undesirable color. To modify this objection German tanners blend it with myrobalans, valonia, sumac and similar materials; the British, with pine, oak and mimosa barks; and in France the favorite mixture is: Mangrove bark, 30 per cent; hemlock bark, 40 per cent; oak bark, 20 per cent; and mimosa bark, 10 per cent. The French blend yields a superior grade of leather with an excellent color for general use.

Eimer & Amend Honor Old-Time Employees

Rudolph Zimmermann and Louis Moses, employed by Eimer & Amend for the past 50 years, were tendered a golden jubilee celebration on June 1 at Cavanagh's restaurant. The happy occasion also marked the completion of 25 years or more of continuous service by the following twenty-four employees: E. Kuehnemann, F. Lange, H. Ferber, D. Frattolillo, F. Kuebler, F. J. P. Arndt, H. E. Broestler, Albert Belling, J. R. Cahill, W. Deuvelsdorf, W. Duncan, P. Effertz, William Harres, C. Klinger, T. Schnecke, H. F. Smith, B. E. Ulrich, H. Wachter, W. Then, M. F. Mai, Mary C. Lyden, Mazie Mejo, M. A. Magee and Louise Sormani.

As a token of appreciation the directors presented to each of the two employees completing 50 years of faithful service a check for $5,000. Reviewing an old custom of the house, those completing 25 years of service were presented with suitably engraved gold watches.

August Eimer, president of the company, presided. The other directors who attended the celebration were: Otto P. Amend, vice-president; Carl G. Amend, secretary and treasurer; E. B. Amend, superintendent; A. O. Eimer, assistant treasurer; W. R. Eimer, assistant secretary, and Elenore Amend, director.

Demand for Paraffin in Vera Cruz

Advices from Mexico state that there is a demand in the Vera Cruz district for paraffin to be used in the manufacture of candles. Candles are universally used by the poorer classes for lighting purposes, and the houses of the better classes, although equipped with electric lights, always have a supply of candles on hand for emergencies. A large number of candles are also used in the churches, it being estimated that during normal times candles to the value of 10,000 pesos a month were used in the churches throughout the republic.

Facts and Figures That Influence Trade in Chemical Products

Market Conditions

Current Prices
Imports and Exports
The Trend of Business

Continued Slow Demand Depresses Prices for Arsenic and Calcium Arsenate

Contract Holders Slow to Take Deliveries—Copper Sulphate Sells at Lower Levels—Imported Caustic Potash Weak—Sal Ammoniac Reduced—Prussiate of Soda Reaches New Low—Bichromates Continue Strong—Permanganate of Potash Irregular but Sells at Advance

REDUCED buying orders and large supplies of imported materials have continued as factors in the local market. This has resulted in further shading of prices and a buyers market is reported for many commodities. Holders of foreign-made oxalic acid have granted concessions and the same holds true for imported caustic potash, prussiate of soda, copper sulphate and sal ammoniac. Arsenic also is listed among the materials which have presented a weak appearance. This appears to be due to failure of consumers to buy in the volume expected and the increase in unsold supplies held by local importers. The position of calcium arsenate also has a bearing on arsenic as the former has not been moving up to expectations and calls for deliveries against contracts are not satisfactory. Predictions of a larger call for arsenic and arsenate, during June, are heard but there is no real indication, as yet, of the accuracy of such predictions.

Many domestic chemicals are holding a firm position. High producing costs, scarcity of labor, sold up condition of producers, and a continued period of active buying, are the principal reasons given for this strength in prices. Among the acids sulphuric and muriatic are very firm due to the unusually large volume of business booked earlier in the season. Acetic acid also is held at the advanced price level which went into effect a few weeks ago. Bichromates have been advanced 1½c. per lb. in the past 2 months and some producers are practically out of the market at present. Scarcity of labor undoubtedly has restricted production of bichromates and competition among sellers has been practically eliminated.

Official figures show that exports of chemicals in April were about the same in value as for the month preceding. The soda products figured prominently in the export totals. At present export demand for chemicals is not heavy. Caustic soda, which was shipped to various countries earlier in the year, is still moving well but new orders for June and July shipment are not coming to hand in a large way and prices have eased off but are still too high to arouse interest in markets abroad.

Agricultural chemicals have been featured by placing of contracts for sulphate of ammonia. Nitrate of soda has met with only moderate buying interest and other fertilizer materials have found the usual seasonable conditions prevailing. Potash salts have received considerable attention and large orders are reported as about to be placed.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	177.64
Last week	177.58
June, 1918	272.00
June, 1919	229.00
June, 1920	274.00
June, 1921	147.00
June, 1922	157.00

Easier prices prevailed for copper sulphate, caustic soda for export, benzene and linseed oil, but so far as the index number was concerned the advance in crude cottonseed oil more than offset the declines. The index number was raised 6 points in the past week.

Acids

Acetic Acid—The various grades have come in for more attention and in different quarters it is reported that the movement to consumers is satisfactory. There has been no change in asking prices, but with producing costs holding up, the situation looks firm as long as buyers show a willingness to take on supplies. Quotations are: 3.38c. per lb. for 28 per cent; 6.75c. per lb. for 56 per cent, and 12@12.78c. per lb. for glacial.

Boric Acid—Call for export is said to be very light but a fairly steady movement to domestic users has kept stocks from accumulating and in general the market is regarded as healthy. The quotations of producers are well maintained at 10@11½c. per lb. with the range varying according to container.

Citric Acid—Different reports are heard about supplies of domestic makes. In some cases it is stated that producers are behind with contract deliveries while other reports say that imported material is of no interest because of its high price and because domestic goods are offered freely enough to fill consuming requirements. The lowest price heard for imported was 52c. per lb. on spot and shipments are higher than the spot price. The movement of prices seems to depend on demand as a larger buying movement would have a strengthening effect. Domestic is still quoted at 49@50c. per lb.

Lactic Acid—Foreign offerings have been too high in price to be much of a factor and the market is in control of domestic producers. Moderate sized amounts are moving well and values are well maintained with sellers quoting: 4½@5½c. per lb. for 22 per cent dark and 5½@6½c. per lb. for light; 9½@10½c. per lb. for 44 per cent dark and 11½@12½c. per lb. for light.

Muriatic Acid—Buying orders have fallen off in volume and a quiet week was reported. Stocks, however, are light and some producers are using their output to take care of contracts. Prices are quoted at 90c.@$1 per 100 lb. for 18 deg. in tanks, with the 22 deg. acid held at $1.75@$2.

Oxalic Acid—Lack of consuming interest has weakened values for imported grades. Holders have been willing to shade prices in order to lessen stocks on hand and there were open quotations at 13c. per lb. Even at the lower prices there was no activity among buyers and only small lots were said to be moving.

Sulphuric Acid—Some of the large consuming trades are not so active at present and call for this acid is less urgent than a short time ago. However, producers, for the most part, have had no chance to accumulate stocks as contract deliveries still take up the bulk of production. Prices are firm at $9.50@$12 per ton for 60 deg. and $15@$16 per ton for 66 deg.

Tartaric Acid—Domestic grades are reported to be strong at an inside price of 37½c. per lb. Imported was rather easy and offerings were on the market at 36½c. per lb. with intimations that on firm bid, odd lots could be picked up under that figure.

Potash

Bichromate of Potash—Buyers are not keen to trade heavily at current prices but sellers are not burdened with stocks and there is no sign of weakness. First hands are holding 11½c. per lb. as an inside quotation and resale material is not a factor in the present market.

Caustic Potash—This material was offered freely by importing firms at 7½c. per lb. and the market for foreign goods has failed to gain any strength. Holdings on spot have been difficult to dispose of and while some shipment quotations have been above the spot selling price, they had no effect on buyers or

sellers. Some factors say that foreign markets are very anxious to keep up volume of sales and selling pressure may keep up for some time.

Carbonate of Potash—Buyers were still able to do 6½c. per lb. in the spot market for 80-85 per cent and forward positions also were offered at that price. Hydrated 80-85 per cent was quiet and easy with 7½c. per lb. given as representing the price for spot goods. On shipments 7½c. per lb. also was quoted but this figure was said to be subject to some shading. Some offerings of 90-95 per cent are said to be on the local market at very attractive prices, in fact it has been quoted as low as the 80-85 per cent.

Permanganate of Potash—While some sellers report prices as irregular with the tone easy, there was an attempt to stabilize values and many sellers were asking 19c. per lb. In fact at least one large lot was sold at the 19c. per lb. level. The shipment market was dull and merely nominal in the absence of buying interest. Many hold that prices will decline considerably from present levels but if anything the market appeared firmer than last week.

Prussiate of Potash—Red prussiate was very quiet and no change of importance was noted. There is some difference in price according to sellers with 65c. to 68c. per lb. covering sellers' views. Yellow prussiate has not been moving well for some time and buyers are interested only when prices are made attractive. The spot market is held at 36@36¾c. per lb. with shipments little better than nominal around the spot prices.

Sodas

Soda Ash—New business is not heavy but is fair considering present trading standards. Withdrawals against contracts are going on steadily and this absorbs large quantities. As a result producers are not carrying large stocks. Prices are firm with producing costs said to have advanced since the present price schedule was adopted. Quotations remain at 1.20c. per lb. in single bags for carlots at works and 1.40c. per lb. in bbl., basis 48 per cent.

Acetate of Soda—Only moderate demand has been reported for several weeks and judging from a supply and demand basis there is nothing in sight to bring about a recovery in prices. Sellers offer spot goods at 5½@6c. per lb.

Bichromate of Soda—There is undoubted firmness in the market. Some sellers are not offering freely and some of the leading factors are holding out for 9c. per lb. for carlots with the usual advance for less than carlots. Stocks do not appear to be large in any quarter and reports of diminished output are borne out by the inability of certain sellers to take on orders for prompt shipment. Fair inquiry is reported but higher prices have curtailed interest in large lots.

Caustic Soda—Improvement in export business has not been noted and while prices are subject to some negotiation there was an easier feeling, especially with reference to the so-called outside brands and as low as 3.22½c. per lb., f.a.s. New York, was heard. For standard brands the quotation was held at 3.35c. per lb., f.a.s. Deliveries to domestic consumers remain of good proportions and the price is steady at 2½c. per lb. for carlots, works, basis 60 per cent. For spot material the quotation is 3½c. per lb., flat.

Cyanide of Soda—A large lot of imported cyanide was sold during the week at 20c. per lb. Demand has not been active and the price for imported while generally held at 20½c. per lb. and upward is subject to shading on desirable business. Domestic makers are holding their goods at 22@23c. per lb.

Fluoride of Soda—Sales of imported goods were reported at 9c. per lb. with 9@9½c. per lb. covering the prices asked. The market as reported was inactive with scattered inquiry. Domestic fluoride is not a factor in the local market and is quoted at 10½@11c. per lb.

Prussiate of Soda — Producers of domestic grades have announced a price of 16c. per lb. for June deliveries. Demand has fallen off and weakness in price has failed to bring about any large buying. Imported prussiate was decidedly weak and as low as 15c. per lb. could be done according to local handlers. Competition between domestic and foreign sellers is keen and the market is not in a position to withstand selling pressure.

Sulphide of Soda—There is a firm tone to the market for domestic material and fused is well maintained at 4½c. per lb. and broken at 5½c. per lb. Crystals are in small supply and are quoted at 2¾c. per lb. Imported sulphide is less firm in tone and prompt shipment is reported as available at 3½c. per lb. For spot imported the lowest figure heard is 3.60c. per lb.

Miscellaneous Chemicals

Arsenic—The fact that buying has not improved to the extent expected is a disturbing factor. Large lots had been imported in recent weeks and a good part of these arrivals were not sold but were held to take care of the demand which had been predicted would follow. So far this demand has been far from as heavy as predicted. Some holders of contracts also are slow in ordering out goods and prices are sagging as certain holders get tired of carrying stocks. There were offerings on spot as low as 14c. per lb. and even this price was not considered strong by some members of the trade. Domestic arsenic is passing direct to consumers and has not been much of a factor in the spot market. Prices for domestic have been under the levels openly quoted for spot material. Producers quote shipments over the last half of the year at 11c. per lb. and July shipment at 12½c. per lb.

Bleaching Powder—While new business is not heavy there is a steady delivery against old orders and producers are not forced to press matters in view of the ready absorption of stocks. Prices are steady at 1.90c. per lb. for large drums at works.

Cream of Tartar—The market is easy in tone with imported material offered freely and buyers are not taking on much. Spot prices are 25½@26c. per lb. and forward positions are offered about 1c. per lb. under the spot levels.

Calcium Arsenate—Very little if any improvement in demand was reported last week and despite reports that June would bring out a better call for stocks, the market has been easy in tone. The open quotation is given at 16c. per lb. but this could be shaded materially and the actual trading basis was largely a matter of private terms between buyer and seller.

Copper Sulphate—A sale of imported copper sulphate was reported at 5c. per lb. There is very little stability to prices for goods of foreign origin and while some holders are refusing to sacrifice, others are willing to meet buyers' ideas in order to get rid of stocks. Open quotations for imported in the latter part of the week ranged from 5.10c. per lb. to 5⅜c. per lb. with the range depending on seller and make. Domestic goods were held at 5.90c. per lb. for large crystals.

Chloride of Barium—The market is suffering from the lack of interest taken by consumers and prices are not holding any too steady. Quotations are given at $85@$90 per ton for spot or futures, but reports are heard to the effect that bids under the inside figure have found acceptance.

Formaldehyde—First-hands reported a steady market and maintained prices at 15@15½c. per lb., the inside figure obtaining on round-lots. The demand was moderate only, and it was reported that a few odd lots held by second-hands could have been secured at 14½@14¾c. per lb.

Sal Ammoniac—Further reductions in price were heard for imported goods and 6c. per lb. was given as the figure at which buyers could operate. Domestic makers were holding nominally unchanged at 7½@7¾c. per lb. with gray at 8@8½c. per lb. f.o.b. works.

Alcohol

Producers reported a fair volume of business and prices for the denatured ruled steady at the recent advance. Several small parcels of denatured arrived at New York from the West Indies. The special grade, formula No. 1, held at 35c. per gal. in drums, the customary premium obtaining for wooden containers. The formula No. 1, completely denatured, held at 43c. per gal., in drums. The market for ethyl spirits was nominally unchanged on the basis of $4.70 per gal. for the 190 proof, U. S. P. Methanol was unchanged, closing at $1.18 per gal. on the 95 per cent and $1.20 on the 97 per cent.

Coal-Tar Products

Spot Phenol and Naphthalene Unsettled on Freer Offerings—Benzol Easier—Solvent Naphtha Holds Firm

THE volume of new business placed in the coal-tar division of the chemical market did not come up to expectations and with selling pressure in evidence in some of the items in the list prices appeared to be more or less unsettled. Interest centered in phenol and scattered lots held by second hands sold at prices ranging from 45@50c. per lb. Rumors were about to the effect that new production would soon come out at comparatively low prices and this frightened some holders of spot goods. In naphthalene the market was easy and sales of flake were put over at 8¼c. per lb. The recent reduction in gasoline finally did bring out a lower range of prices on benzene and from all indications offerings were plentiful at the recently reduced level. In solvents, however, the situation continues to favor sellers and while no price changes were announced some traders felt that a higher trading level was not at all out of the question. Salicylic acid was inactive and prices in several quarters were considered barely steady. Several shipments of pitch arrived from English ports during the past week, but, upon investigation, it was learned that this material was not a coal-tar product.

According to official figures exports of coal-tar products from the United States for the first quarter of the year were valued at $2,761,118, which compares with $1,810,331 for the corresponding period a year ago. Most of the exports consisted of crudes. Producers say that domestic business over the first quarter also gained considerably, contrasted with the corresponding period a year ago.

Aniline Oil—Trading last week was inactive, but leading makers continued to quote the market as steady on the basis of 16c. per lb. on carload lots, immediate and nearby delivery.

Aniline Salt—While several handlers held out for 23½@24c. per lb. in the salt, others offered supplies freely at 23c. per lb. Demand was quiet.

Benzaldehyde—With not much available on spot the market ruled steady. The lull in trading had little or no influence upon sellers, who continued to quote on the basis of 75c. per lb., nearby delivery.

Benzene—Increased competition with gasoline was reflected in easier prices on benzene and it develops that leading interests lowered prices a short time ago. The 90 per cent grade was offered by leading producers at 25c. per gal., tank cars, f.o.b. works, with the pure at 27c. per gal., in tank cars, f.o.b. works. The pure in drums, on spot, closed nominally at 30@32c. per gal.

Creosote—There were offerings of the 25 per cent for immediate shipment at 26c. per gal. Demand was slow and prices were barely steady.

Cresylic Acid—The market for cresylic was unsettled all week so far as second-hand offerings were concerned and closing prices were more or less nominal, depending upon the seller and quantity. On the 97 per cent grade there were offerings on spot at $1.15 per gal. Domestic producers had nothing to offer except on contract to regular consumers. There were no new developments in connection with the tariff situation.

Dimethylaniline—Producers reported a steady market for this intermediate, the output apparently being well taken care of. Prices were repeated at 42@43c. per lb., prompt and nearby delivery.

Naphthalene—An irregular market was witnessed on flake for immediate delivery and offerings late in the week could be located at 8¼c. per lb. In fact several lots sold at this figure. Demand was inactive, the weakness in foreign crude restricting business. New contract prices by domestic producers were not announced, but it was intimated that the quotations will show a higher trading level contrasted with last year's contract basis. Imported crude for shipment settled around 3¼@3½c. per lb.

Phenol—Sales of U.S.P. phenol went through in outside channels, for immediate delivery, as low as 45c. per lb., which compares with 50c. per lb., the settling price a week ago. The market on re-sale goods was irregular and prices at the close were considered to be little more than nominal. It was rumored that new production could be purchased for deferred delivery at prices considerably below 28c. per lb., and this kind of talk brought out a feeling of uneasiness and restricted business to a minimum.

Salicylic Acid—No further price changes were announced, but factors reported a quiet market with the undertone barely steady, due, in part, to the easier feeling in phenol. One prominent producer offered the U.S.P. grade at 45c. per lb., while others named a price of 40c. per lb. Some traders raised some questions about the 40c. quotation, claiming that round-lots could not be obtained at this figure. However, as no inquiry developed for round-lots the "argument" could not be settled.

Solvent Naphtha—Large producers say that there is a ready market for all of the solvent naphtha available and they regard the general situation as firm. Nominal quotations were repeated at 27@32c. per gal., the inside figure prevailing on tank car business.

French Chemist Claims He Can Dissolve Coal

A process has been devised whereby coal can be dissolved much in the same manner as sugar dissolves in water, according to an announcement made before the Paris Society of the Chemical Industries by A. Kling, director of the Parisian Municipal Chemical Laboratory. The experiments were conducted in co-operation with Florentin and Pictet. Dr. Kling contends that they succeeded in suspending a pure pulverized coal in carburetted hydrogen and by subjecting it to pressure and heat a solution resulted from which motor fuels and other products can be made.

What Is Standard Newsprint?

The definition of standard newsprint, made necessary for the purpose of admitting that commodity under the free list of the tariff act, has been difficult to make. Newspaper interests have protested the tentative formula suggested by Secretary Mellon. This formula defined standard newsprint as a commodity weighing approximately 32 lb. to the ream, 24 x 36 in., and composed of a mixture of mechanically ground wood pulp and sulphite pulp in the relative proportions of 80 per cent and 20 per cent. Clauses for taking care of slight variations were also included. It is expected that despite the delay occasioned by the protest the final ruling will soon be issued.

Latest Quotations on Industrial Stocks

	Last Week	This Week
Air Reduction	61½	64¼
Allied Chem. & Dye	68⅝	71
Allied Chem. & Dye pfd	110	110
Am. Ag. Chem.	17½	19½
Am. Ag. Chem., pfd	40	42½
American Cotton Oil	9⅝	8
American Cotton Oil, pfd	19	17¾
Am. Drug Synd	5½	5⅝
Am. Linseed Co	23	26⅝
Am. Linseed Co., pfd	43	44
Am. Smelting & Refining	55⅞	61⅛
Am. Smelting & Refining, pfd	96½	98
Archer-Daniels Mid. Co., w.i.	37½	36½
Atlas Powder	170	*170
Atlas Powder, pfd	90	*90
Casein Co. of Am	*60	*60
Certain-Teed Products	*40	*40
Commercial Solvents	29¼	28
Corn Products	126⅝	131⅛
Corn Products, pfd	118	118
Davison Chem.	23⅛	24¼
Dow Chem. Co	46	46
Du Pont de Nemours	123⅞	126¾
Du Pont de Nemours, db	86	85
Freeport-Texas Sulphur	13½	14¼
Glidden Co.	8½	8¼
Grasselli Chem.	*130	133
Grasselli Chem., pfd	*103	104
Hercules Powder	105	105
Hercules Powder, pfd	105	105
Heyden Chem.	2	2
Int'l Ag. Chem. Co	5⅞	5⅛
Int'l Ag. Chem. Co., pfd	16⅛	17
Int'l Nickel	13¼	14
Int'l Nickel, pfd	79	78½
Int'l Salt	*90	*90
Mathieson Alkali	44⅝	49
Merck & Co	86⅞	87
National Lead	113¾	124
National Lead, pfd	112	112⅛
New Jersey Zinc	162	162
Parke Davis & Co	81	*81
Pennsylvania Salt	88	88
Procter & Gamble	*140	*140
Sherwin-Williams	28⅞	*29
Sherwin-Williams, pfd	*101	*101
Tenn. Copper & Chem	9⅜	9⅞
Texas Gulf Sulphur	60⅞	62¾
Union Carbide	56⅝	58½
United Drug	80	80
U. S. Intl. Alcohol	51⅝	56
Va.-Car. Chem. Co.	10	10
Va.-Car. Chem. Co., pfd	30	27¼

*Nominal. Other quotations based on last sale.

Vegetable Oils and Fats

Linseed Dull and Easier—Crude Cottonseed Steady—China Wood Declines—Tallow Slightly Higher

BUSINESS showed no improvement and an easier feeling prevailed in most quarters of the vegetable oil trade. Crude cottonseed was a shade firmer than a week ago, while tallow actually sold at a slight advance, but these developments were more than offset by the unsettlement in linseed, china wood, coconut and palm oils. Traders were interested in the oil seeds situation, especially the new crop developments in cotton. Advices from Europe indicated that business in vegetable oils was anything but satisfactory. Easier prices were reported in hogs, in the western markets, which was reflected in the unsettled market for lard.

Linseed Oil—Demand was dull and with seed markets lower the undertone at the close was easy. There were offerings of prompt shipment oil on the basis of $1.12 per gal., carload lots, cooperage included, but most traders in the domestic product continued to quote $1.14 per gal. On second-half of June business, however, several crushers stood ready to trade at $1.12 per gal., with a possibility of shading this figure on a firm bid. July oil was offered at $1.04 per gal., in cooperage, with August forward at $1 per gal. Large consumers showed no buying interest in futures. The absence of new business will do much to ease the supply situation and it seems altogether probable that stocks of oil will be something like normal in another month or so. During the past week foreign oil for prompt shipment from New York was offered on the ex-dock basis of $1.02 per gal., in cooperage, duty paid, one lot of approximately 1,000 barrels pressing on the market. English oil for June shipment from the other side was offered freely at $1.02 per gal. landed weights, duty paid, c.i.f. New York. London cables reported dull trading in all of the British as well as Continental markets. Offerings of Argentine seed increased, while Indian sellers also appeared more anxious for business. During the week previous 28,000 bushels of Indian seed were shipped to the United States. The stocks of flaxseed at Minneapolis increased to 19,236 bushels in the past week, which compares with 9,396 bushels a week ago and 62,517 bushels on the corresponding date a year ago. Minneapolis reported dull trading in linseed meal, the market settling around $37 per ton. New York exporters said that foreign inquiry for cake was absent and prices of $33@$34 per ton f.a.s. were wholly nominal.

Cottonseed Oil—The option market on the Produce Exchange was a narrow affair, yet prices held remarkably steady considering the small volume of sales and the irregularity in competing oils and fats. The developments in cotton were not considered favorable and the speculative element refused to operate in the new crop months on an extensive scale. The spot position in prime summer yellow oil settled around 11.80c. per lb., bid, which compares with a 10c. market on October and 9c. for December. Traders look for no important movement in old crop prices, notwithstanding the fact that the statistical position is extremely tight. Cash trade in oil was inactive, while business in lard compound also was slow. Several cars of crude oil actually sold at 10c. per lb., f.o.b. mills, an advance of ¼c. from the nominal price named a week ago. The offerings of crude were scanty. Nothing was heard in connection with new crop crude oil. Bleachable oil for prompt shipment from Texas common points closed nominally at 10½c. per lb.

China Wood Oil—The feature in the market was the easier position of futures. There were offerings of July-August-September shipment from the Pacific coast at 19c. per lb., but this failed to bring out any buying interest. Spot oil in New York was available at 25½@28c. per lb., the inside figure obtaining on a tank car.

Coconut Oil—Several cars of Ceylon type oil sold for prompt shipment from New York at 8⅝c. per lb., which price prevailed up to the close. Trading, taken as a whole, was inactive, and the undertone easy in sympathy with copra. On the Pacific coast there were offerings of nearby oil on the tank car basis of 8c. per lb., with forward material available at 7⅞c. per lb. Copra was offered at 4¾c. per lb., c.i.f. Pacific coast ports, and at 5c. per lb., c.i.f. New York. It was reported that buyers' views were nearer 4½c. per lb., c.i.f. coast.

Corn Oil—The market for crude was up a little in the west, last sales going through at 9½c. per lb., f.o.b. point of production. This quotation represents a gain of ¼c.

Olive Foots—There were sellers at 9@9½c. per lb., spot, with business dull. On futures the market for prime green settled at 9c. asked.

Palm Oils—The market was inactive, but the slight recovery in tallow brought out a better feeling. Lagos settled nominally at 7⅜@7½c. per lb., with Niger at 7@7¼c. per lb., the price depending upon the position.

Menhaden Oil—Chesapeake Bay advices indicate that only one-half of the fleet of 46 boats took part in the first week's fishing operations. A fair catch was reported. The market for oil was dull so far as new business was concerned, but traders continued to quote 50c. per gal., tank cars, f.o.b. factory.

Tallow and Greases—The sale of several hundred drums of extra tallow was put through about a week ago at 7⅝c. per lb., an advance of ⅛c. Offerings were not pressing on the market, but inquiry at the advance fell away quite perceptibly. Soapers refused to anticipate their wants. Yellow grease was steady, closing nominally at 7c. asked on low acid stock. Oleo stearine held at 9c., the last trading basis.

Miscellaneous Materials

Glycerine—Reports on the condition of the market were conflicting, but most traders regarded the situation as a little more favorable, especially where the C. P. grade was concerned. Some contract business was put through around 17c. per lb., in drums, carload lots. In the middle west C. P. was offered at 16½c. On a brand not so well established there was a possibility of doing 16½c., New York. The dynamite grade was inactive and nominally unchanged at 15¾@16c. per lb. Soap-lye crude, basis 80 per cent, closed at 11c. asked, loose, New York. An odd car or so sold during the week at concessions. Western producers held out for 10½c. on the soap-lye. Saponification, 88 per cent, closed nominally at 12¼@12½c. per lb., loose, with no sales reported.

Naval Stores—The market developed further weakness and toward the close spirits of turpentine stood at $1.06@$1.08 per gal. Demand was quiet, both in an export and domestic way. Southern markets were subjected to a little pressure. Rosins did not change much, the lower grades closing at $5.95@$6.10 per bbl.

Chalk—Importations have been heavy, but demand continues satisfactory and quotations ruled steady at $5@$5.50 per ton, cargo basis, c.i.f. New York.

Shellac — Early in the week prices went off a little, but later offerings were not so plentiful and with Calcutta advices slightly firmer the market steadied a little. Buying was hand-to-mouth in character and traders appeared to show no desire to book ahead under present conditions. T. N. on spot settled at 58@59c. per lb. Bleached, bonedry, closed at 72@73c. per lb. Superfine orange was offered at 64@65c. per lb.

Lithopone — Domestic producers admit that business has slowed up a bit, but with no change in basic material they continue to quote from 7@7¼c. per lb., carload lots, the inside figure obtaining for the material put up in bags.

White Lead, Etc.—The metal held at 7.25c. per lb., New York. Since the reduction in pig lead prices, which occurred about a month ago, corroders have not altered prices for the pigments. Business in white lead has been quite active and this accounts for the steady position of the leading producers. Dry white lead, basic carbonate, held at 9¾c. per lb., in casks, round-lots. Dry red lead held at 11¾c., in casks. Litharge was unchanged at 10¾@11c. per lb.

Zinc Oxide—Prices were repeated at 8c. on the lead free and 7@7¼c. on the 10@35 per cent leaded, American process oxide. French process held at 9¾c. on the red seal, in bags. The market was steady.

Financial Notes

Belgo Paper Co., of Montreal, which is passing into Canadian control, shows average net earnings after maintenance and repairs of $1,742,570 for the past four years, and $1,989,054 for eight months ended April 30.

American Druggists Syndicate has notified stockholders change in par value of capital stock from $10 to $50, recently authorized at a special meeting of stockholders, cannot be carried out, owing to fact publication of notice has not been legally complied with. This will necessitate another meeting to properly authorize the change, for which due notice will be given.

Glidden Co. and subsidiaries for six months ended April 30, 1923, show net profit of $445,106, after interest, federal taxes, reserve for contingencies and depreciation. Company states that fiscal year begins November 1, and consequently above statement covers operations during five cold and unseasonable months of the year. Business for the last six months covers the real paint and varnish consuming months.

Formal transfer of Acme Cement Plaster Mills at Acme has been made to the Certain-teed Products Corp. of New York.

Special meeting of stockholders of Standard Oil Co. of New York, scheduled for last week, to approve proposed increase in authorized capital stock from $225,000,000 to $300,000,000 of $25 par, was not held as not sufficient proxies were received to comply with statutory provisions.

The balance sheet of the Pacific Oil Co., covering operations in 1922, shows a surplus of $11,792,226 after depreciation, depletion, federal taxes, etc., equivalent to $3.37 a share on its 3,500,000 shares of outstanding no par value stock. In 1921 net income amounted to $16,261,292, or $4.64 a share on the stock.

The United Dyewood Corporation reports for the past year's operation a balance of $1,816,212 available for dividends on the common stock. This is equivalent to $13.04 a share on the 139,183 shares outstanding.

The Chino Copper Co. reports for the first quarter of 1923 total income, exclusive of depreciation and federal taxes, of $405,611, equal to 45c. a share on the 900,000 shares of capital stock of $5 par value outstanding. This compares with total income of $182,629, or 20c. a share, in the final quarter of 1922.

The American Copper Mining Co. has announced that on and after June 30, 1923, it would redeem all its outstanding 7 per cent, 10-year secured gold bonds, series B, at a premium of 3 per cent.

Imports at New York

May 25 to May 31

ACIDS—89 dr. cresylic, London, Celluloid Co.; 280 bx. formic and 30 csk. oxalic, Rotterdam, W. R. Greeff & Co.; 183 dr. cresylic, Liverpool, Order; 200 keg. tartaric, London, Russian Produce Co; 100 csk. citric, Palermo, R. F. Downing & Co.; 150 csk., Palermo, W. Neuberg; 140 csk. tartaric, Palermo, Order; 100 csk. citric, Palermo, Order.

AMMONIUM—20 pkg. carbonate, Liverpool, Brown Bros. & Co.

ALCOHOL—200 bbl. Arecibo, C. Estena.

ARSENIC—51 csk., Liverpool, Order; 100 bbl., Tampico, Am. Metal Co.

ASBESTOS—1239 bg., Southhampton, W. D. Crompton & Co.

BARIUM BINOXIDE—63 cylinders, Havre, Mallinckrodt Chem. Works.

CAMPHOR—100 cs., Hamburg, A. Ochse Co.

CASEIN—298 bg., Bombay, Casein Mfg. Co.; 163 bg., Bombay, Order; 417 bg., Buenos Aires, Equitable Trust Co.; 1667 bg., Buenos Aires, Kalbfleisch Corp.; 163 bg., Havre, N. Y. Trust Co.

CERIUM FLUORIDE—40 csk., Hamburg, Pfaltz & Bauer.

CHEMICALS—12 cs., Antwerp, Vandegrift & Co.; 107 pkg., Rotterdam, Order; 90 csk., Bremen, Roessler & Hasslacher Chem. Co.; 38 csk., Bremen, Order; 120 csk., Newcastle, E. Hills Son & Co.; 32 bbl., Hamburg, A. Murphy & Co.; 45 bbl., Hamburg, Roessler & Hasslacher Chem. Co.

COLORS—22 cs. dry, London, R. F. Downing & Co.; 10 csk., Liverpool, Order; 4 csk. aniline, Havre, Irving Bank-Col. Trust Co.; 12 pkg. do., Havre, W. Sykes & Co.; 6 csk., Havre, B. Bernard; 5 csk., Havre, H. R. Ackerman; 22 csk., Havre, Geigy Co.; 129 csk., Havre, Ciba Co.; 2 bbl., Antwerp, B. Bernard; 12 pkg., Havre, Irving Bank-Col. Trust Co.; 9 csk., Rotterdam, H. A. Metz & Co.; 6 pkg., Rotterdam, Organic Products Co.; 21 cs., Hamburg, E. C. Foster; 40 csk., Hamburg, Kuttroff, Pickhardt & Co.; 6 csk., Hamburg, H. A. Metz & Co.; 10 csk., Hamburg, H. R. John; 10 csk., Hamburg, Equitable Trust Co.; 13 csk. dry, Southampton, Stanley Doggett, Inc.; 126 csk. aniline, Havre, Ciba Co.; 26 bbl. dry, Havre, Reichard-Coulston, Inc.; 44 csk. earth, Hamburg, Reichard-Coulston, Inc.

COPPER SULPHATE—100 csk., Hamburg, A. J. Marcus.

COPPER OXIDE—50 dr., Hamburg, American Metal Co.; 14 csk., Newcastle, Int'l Comp. Co.

CREAM TARTAR—40 bbl., Bordeaux, R. W. Greeff & Co.

COPRA—100 bg., Santiago, Order; 477 bg., St. Anns Bay, Order; 152 bg., Morant Bay, Franklin Baker Co.

DEGRAS—90 bbl. Bordeaux, Order; 60 csk., Bremen, C. H. Hilbert; 150 bbl., Hull, Nat'l City Bank.

DIVI-DIVI—75 bg., Maracaibo, Int'l Forwarding Co.

DYESTUFFS—2 csk., Southampton, Am. Exchange Nat'l Bank; 3 csk., Havre, Carbric Color & Chem. Co.

FERROSILICON—511 csk., Stockholm, C. Hardy & Ruperty; 328 cs., Skien, Norwegian Nitrogen Products Co.; 320 cs., Skein, Order.

FUSEL OIL—11 csk., Havre, Order; 19 dr., Dunkirk, Guaranty Trust Co.; 16 dr., Dunkirk, Mass & Waldstein.

GLYCERINE—20 csk., Bordeaux, Order; 35 csk., Havre, Thornett & Fehr.

GUMS—58 bg. tragacanth, Bombay, Goschens & Cunliffe; 486 bg. Persian, 140 bg. karaya and 180 bg. arabic, Bombay, Guaranty Trust Co.; 140 bg. karaya, Bombay, Brown Bros & Co.; 68 bg. tragacanth and 560 bg. karaya, Bombay, Order; 105 bg. copal, Antwerp, Brown Bros & Co.; 409 pkg. do., Antwerp, Chem. Nat'l Bank; 915 bg. copal, Antwerp, Order; 320 bg. copal, Antwerp, H. W. Peabody & Co.; 30 bg. copal, Liverpool, Order.

IRON OXIDE—18 csk., Liverpool, J. A. McNulty; 70 csk., Liverpool, Reichard-Coulston, Inc.; 17 csk., Liverpool, L. H. Butcher & Co.

MANGROVE BARK—1,352 bg., Hamburg, Bingham & Co.; 8,000 bg., Hamburg, Bingham & Co.

MINERAL WHITE—200 bg., Hull. C. B. Chrystal & Co.; 1,200 bg., Hull, Hammill & Gillespie.

MYRABOLANS—2,312 bg., Bombay, Fourth Atl. Nat'l Bank; 4,766 bg., Bombay, Order; 9,720 pkt., Calcutta, Nat'l City Bank; 15,006 pkt., Calcutta, Standard Bank of South Africa; 4,480 pkt., Calcutta, Order.

NAPHTHALENE—660 bg., Liverpool, Martin & Co.; 1,162 bg., Liverpool, Order.

OILS—Castor, 100 bbl., Hull, Order. **Coconut**—114 pipes, Cochin, Volkart Bros.; 94 hhds., Cochin, Order. **Cod**—100 bbl., Aberdeen, Order. **Linseed**—285 bbl., Rotterdam, Thomas Tucker & Co.; 146 bbl., Rotterdam, Lockwood & Co.; 200 bbl., Southampton, Hudson Oil Co.; 867 bbl., Hull, National City Bank; 897 tons (bulk) Hull, Order. **Rapeseed**—1,000 bbl., Liverpool, Vacuum Oil Co.; 100 bbl., Hull, National City Bank; 500 bbl., Hull, Vacuum Oil Co.; 425 bbl., Hull, Order. **Sesame**—100 dr., Rotterdam, Order. **Palm**—128 csk., Liverpool, African & Eastern Trading Corp.; 100 csk., Liverpool, E. F. Drew & Co.; 496 csk., Liverpool, Order; 158 csk., Rotterdam, J. Holt & Co.; 37 csk., Liverpool, Standard Bank of S. Africa; 34 csk. and 48 bbl., Liverpool, D. Bacon; 140 csk., Liverpool, Order. **Peanut**—300 bbl., Liverpool, E. F. Drew & Co.; 200 bbl., Hull, E. F. Drew & Co. **Soya Bean**—325 bbl., Liverpool, I. R. Boody & Co. **Whale**—23,200 bbls., Montevideo, Order.

OIL SEEDS—Castor—7,130 bg., Bombay, Volkart Bros.; 1,358 bg., Bombay, Order; 5,464 bg., Coconada, Volkart Bros. **Linseed**—2,563 bg., Montevideo, Order; 17,852 bg., Rosario, Order; 44,730 bg., San Lorenzo, Order, 35,884 bg., Rosario, Order; 16,408 bg., Buenos Aires, Spencer Kellogg & Sons.

POTASSIUM SALTS—2,000 bg. manure salt, Hamburg, Order; 2,000 bg., sulphate, Order; 35 dr. caustic, Bremen, Innis, Speiden & Co.; 1,120 bg., muriate, Bremen, A. Vogel; 3,500 bg., sulphate, Hamburg, Order; 71 csk. carbonate, Hamburg, Peters, White & Co.; 25 dr. permanganate, Hamburg, Order.

PITCH—600 bbl., Hull, Tunley & Co.; 100 bbl., Hull, Order.

PYRIDINE—11 dr., Liverpool, R. W. Greeff & Co.; 9 dr., Liverpool, Order.

QUEBRACHO—50,569 bg., Buenos Aires, Tannin Corp.; 1,074 bg., Buenos Aires, Fourth At'l. Natl. Bank.

QUICKSILVER—250 fl., London, Order.

QUINIDINE—77 dr., Rotterdam, R. W. Freeff & Co.

SHELLAC—600 bg., Calcutta, Philadelphia Nat'l Bank; 250 bg., Calcutta, Order; 100 cs., London, Order; 71 bg., Havre, Standard Bank of South Africa; 35 bg., Hamburg, Order; 740 bg., Calcutta, Brown Bros. & Co.; 10 bg., Calcutta, Lee, Higginson & Co.; 50 bg., Calcutta, Bank of Brit. West Africa; 100 bg., Calcutta, N. Y. Trust Co.; 46 bg., Calcutta, Bank of Montreal; 2,140 pkg., Calcutta, Order; 422 bg., Calcutta, Anglo So. Am. Bank; 537 bg., Calcutta, Bank of N. Y. & Trust Co.; 500 bg. refuse, Calcutta, Bank of Manhattan Co.; 150 bg., Calcutta, First Nat'l Bank of Boston; 550 bg. garnet, Calcutta, Bank of America; 50 bg., Calcutta, London & Braz. Bank; 50 bg., Calcutta, Mech. & Metals Nat'l Bank; 500 bg., Calcutta, Chase Nat'l Bank; 1,002 bg., Calcutta, Order.

STARCH—250 bg. potato, Rotterdam, Chatham & Phenix Nat'l Bank.

SODIUM SALTS—168 cs. cyanide, Havre, C. Hardy & Ruperty; 250 cs. cyanide, Havre, Meteor Products Co.; 243 cs., Havre, Asia Banking Corp.; 34 csk. prussiate, Liverpool, H. J. Baker & Bros.; 113 csk. hydrosulphite, Rotterdam, H. A. Metz & Co.; 4,115 bg. and 343 csk. synthetic nitrate, Skien, Order; 25,089 bg. nitrate, Antofagasta, Wessel, Duval & Co.; 92,317 bg. nitrate, Tocopilla, Wessel, Duval & Co.; 15,766 bg. nitrate, Mejillones, W. R. Grace & Co.; 29 dr. perborate, Hamburg, International Acceptance Bank; 55 dr. sulph.-hydrate, Hamburg, C. S. Grant & Co.

SUMAC—200 bl., Palermo, Order.

TANNING EXTRACT—30 csk., Liverpool, Brown Bros. & Co.

TARTAR—100 bg., Bordeaux, Order.

TURMURIC—369 bg., Aleppy, Darragh, Small Co.; 1,400 bg., Cochin, Order.

ULTRAMARINE—16 csk., Liverpool, Fezandie & Sperrle.

WHITING—5125 bg., Dunkirk, Taintor Trading.

WAXES—32 bg. bees, London, Order; 20 bg. bees, Rio de Janeiro, London & Brazilian Bank; 18 bg., Rio de Janeiro, Storrs Mica Co.; 34 pkg. bees, Havana, Order; 100 cs. spermacette, Glasgow, Order.

ZINC OXIDE—34 csk., Liverpool, L. H. Butcher & Co.

ZINC WHITE—20 bbl., Southampton, Houbegart, Inc.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

THESE prices are for the spot market in New York City, but a special effort has been made to report American manufacturers' quotations whenever available. In many cases these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported stocks are reported when they are of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals

Acetic anhydride, 85%, drums	lb.	$0.38 –	....
Acetone, drums	lb.	.25 –	.25½
Acid, acetic, 28%, bbl	100 lb.	3.38 –	3.50
Acetic, 56%, bbl	100 lb.	6.75 –	7.00
Glacial, 99½%, bbl	100 lb.	12.00 –	12.50
Boric, bbl	lb.	.10½ –	
Citric, kegs	lb.	.49 –	.52
Formic, 85%	lb.	.14 –	.16
Gallic, tech	lb.	.45 –	.50
Hydrofluoric, 52%, carboys	lb.	.12 –	.12½
Lactic, 44%, tech., light, bbl	lb.	.11½ –	.12
22% tech., light, bbl	lb.	.05½ –	.06
Muriatic, 18° tanks	100 lb.	.90 –	1.00
Muriatic, 20°, tanks	100 lb.	1.00 –	1.10
Nitric, 36°, carboys	lb.	.04½ –	.05
Nitric, 42°, carboys	lb.	.06 –	.06½
Oleum, 20%, tanks	ton	18.50 –	19.00
Oxalic, crystals, bbl	lb.	.13 –	.13½
Phosphoric, 50% carboys	lb.	.07½ –	.08½
Pyrogallic, resublimed	lb.	1.50 –	1.60
Sulphuric, 60°, tanks	ton	9.50 –	11.00
Sulphuric, 60°, drums	ton	13.00 –	14.00
Sulphuric, 66°, tanks	ton	16.00 –	16.50
Sulphuric, 66° drums	ton	20.00 –	21.00
Tannic, U.S.P., bbl	lb.	.65 –	.70
Tannic, tech., bbl	lb.	.45 –	.50
Tartaric, imp., powd., bbl.	lb.	.36½ –	....
Tartaric, domestic, bbl	lb.	.37½ –	
Tungstic, per lb	lb.	1.10 –	1.20
Alcohol, butyl, drums, f.o.b. works	lb.	.26 –	.28
Alcohol ethyl (Cologne spirit), bbl	gal.	4.75 –	4.95
Ethyl, 190 p'f. U.S.P., bbl	gal.	4.70 –	....
Alcohol, methyl (see Methanol)			
Alcohol, denatured, 190 proof			
No. 1, special bbl	gal.	.41 –	...
No. 1, 190 proof, special, dr.	gal.	.35 –	...
No. 1, 188 proof, bbl	gal.	.42 –	...
No. 1, 188 proof, dr	gal.	.36 –	...
No. 5, 188 proof, bbl	gal.	.40 –	...
No. 5, 188 proof, dr	gal.	.34 –	...
Alum, ammonia, lump, bbl	lb.	.03½ –	.03¾
Potash, lump, bbl	lb.	.02¾ –	.03¼
Chrome, lump, potash, bbl.	lb.	.05½ –	.06
Aluminum sulphate, com., bags	100 lb.	1.50 –	1.65
Iron free bags	lb.	.02½ –	.02¾
Aqua ammonia, 26°, drums	lb.	.06½ –	.07¼
Ammonia, anhydrous, cyl	lb.	.30 –	.30½
Ammonium carbonate, powd. casks, imported	lb.	.09½ –	.10
Ammonium carbonate, powd. domestic, bbl	lb.	.13 –	.14
Ammonium nitrate, tech., casks	lb.	.10 –	.11
Amyl acetate tech., drums	gal.	3.50 –	3.75
Arsenic, white, powd., bbl	lb.	.14 –	.14½
Arsenic, red, powd., kegs	lb.	.14½ –	
Barium carbonate, bbl	ton	78.00 –	80.00
Barium chloride, bbl	ton	85.00 –	90.00
Barium dioxide, drums	lb.	.18 –	.18½
Barium nitrate, casks	....	.08 –	.08½
Barium sulphate, bbl	lb.	.04 –	.04½
Blanc fixe, dry, bbl	lb.	.04 –	.04½
Bleaching powder, f.o.b. wks., drums	100 lb.	1.90 –	....
Spot N. Y. drums	100 lb.	2.40 –	
Borax, bbl	lb.	.05½ –	.05¾
Bromine, cases	lb.	.28 –	.30
Calcium acetate, bags	100 lb.	4.00 –	4.05
Calcium arsenate, dr	lb.	.16 –	.16½
Calcium carbide, drums	lb.	.05½ –	.05¾
Calcium chloride, fused, drums	ton	22.00 –	23.00
Gran. drums	ton	28.00 –	30.00
Calcium phosphate, mono, bbl	lb.	.06½ –	.07
Camphor, cases	lb.	.86 –	.88
Carbon bisulphide, drums	lb.	.07 –	.07¼
Carbon tetrachloride, drums	lb.	.09½ –	.10
Chalk, precip.—domestic, light, bbl	lb.	.04¼ –	.04½
Domestic, heavy, bbl	lb.	.03½ –	.03¾
Imported, light, bbl	lb.	.04½ –	.05
Chlorine, liquid, tanks, wks.	lb.	.05¼ –	.05½
Cylinders, 100 lb., wks	lb.	.06 –	.06¼
Cylinders, 100 lb., spot	lb.	.09 –	....
Chloroform, tech., drums	lb.	.35 –	.38
Cobalt oxide, bbl	lb.	2.10 –	2.25
Copperas, bulk, f.o.b. wks.	ton	20.00 –	21.00
Copper carbonate, bbl	lb.	.19 –	.20
Copper cyanide, drums	lb.	.47 –	.50
Coppersulphate, dom., bbl.,	100 lb.	5.90 –	...
Cream of tartar, bbl	lb.	.25½ –	.26½
Epsom salt, dom., tech., bbl	100 lb.	1.90 –	2.15
Epsom salt, imp., tech., bags	100 lb.	.90 –	1.00
Epsom salt, U.S.P., dom., bbl	100 lb.	2.50 –	2.60
Ether, U.S.P., drums	lb.	.13 –	.15
Ethyl acetate, 85%, drums	gal.	.80 –	.81
Ethyl acetate, pure (acetic ether, 98% to 100%)	gal.	.95 –	1.00
Formaldehyde, 40%, bbl	lb.	$0.14½ –	$0.15¼
Fullers earth—imp., powd., net	ton	30.00 –	32.00
Fusel oil, ref., drums	gal.	.... –	....
Fusel oil, crude, drums	gal.	.... –	....
Glaubers salt, wks., bags	100 lb.	1.20 –	1.40
Glaubers salt, imp., bags	100 lb.	.90 –	.95
Glycerine, c.p., drums extra	lb.	.17 –	.17½
Glycerine, dynamite, drums	lb.	.15½ –	.16¼
Glycerine, crude 80%, loose	lb	.11	.11¼
Iodine, resublimed	lb.	4.55 –	4.65
Iron oxide, red, casks	lb.	.12 –	.18
Lead:			
White, basic carbonate, dry, casks	lb.	.09¾ –	.10
White, basic sulphate, casks	lb.	.09½ –	......
White, in oil, kegs	lb.	.12¼ –	.14
Red, dry, casks	lb.	.11¾ –	.12
Red, in oil, kegs	lb.	.13½ –	.15
Lead acetate, white crys., bbl.	lb.	.14 –	.14½
Brown, broken, casks	lb.	.13 –	.13½
Lead arsenate, powd., bbl	lb.	.23 –	.24
Lime-Hydrated, bbl	per ton	16.80 –	17.00
Lime, Lump, bbl	280 lb.	3.63 –	3.65
Litharge, comm., casks	lb.	.10¾ –	.11
Lithophone, bags	lb.	.07 –	.07¼
in bbl	lb.	.07 –	.07¼
Magnesium carb., tech., bags	lb.	.08 –	.08½
Methanol, 95%, bbl	gal.	1.18 –	1.20
Methanol, 97%, bbl	gal.	1.20 –	1.22
Nickel salt, double, bbl	lb.	.10½ –	....
Nickel salts, single, bbl	lb.	.11½ –	....
Phosgene	....	.60 –	.75
Phosphorus, red, cases	lb.	.35 –	.40
Phosphorus, yellow, cases	lb.	.30 –	.35
Potassium bichromate, casks	lb.	.11½ –	.12
Potassium bromide, gran., bbl	lb.	.19 –	.20
Potassium carbonate, 80-85%, calcined, casks	lb.	.06½ –	.06¾
Potassium chlorate, powd.	lb.	.07½ –	.08
Potassium cyanide, drums	lb.	.45 –	.50
Potassium, first sorts, cask	lb.	.08½	.09
Potassium hydroxide (caustic potash) drums	lb.	.07½ –	.09
Potassium iodide, cases	lb.	3.65 –	3.75
Potassium nitrate, bbl	lb.	.06¾ –	.07¼
Potassium permanganate, drums	lb.	.18½ –	.19
Potassium prussiate, red, casks	lb.	.65 –	.67
Potassium prussiate, yellow, casks	lb.	.35½ –	.36½
Salammoniac, white, gran., casks, imported	lb.	.06 –	.06½
Salammoniac, white, gran., bbl., domestic	lb.	.07½ –	.07¾
Gray, gran., casks	lb.	.08 –	.09
Salsoda, bbl	100 lb.	1.20	1.40
Salt cake (bulk)	ton	26.00 –	28.00
Soda ash, light, 58% flat, bags, contract	100 lb.	1.60 –	1.67
Soda ash, light, basis, 48%, bags, contract, f.o.b. wks	100 lb.	1.20 –	1.30
Soda ash, light, 58%, flat, bags, resale	100 lb.	1.75 –	1.80
Soda ash, dense, bags, contract, basis 48%	100 lb.	1.17½ –	1.20
Soda ash, dense, in bags, resale	100 lb.	1.85 –	1.90
Soda, caustic, 76%, solid, drums, f.a.s.	100 lb.	3.22½ –	3.35
Soda, caustic, basis 60%, wks., contract	100 lb.	2.50 –	2.60
Soda, caustic, ground and flake, contracts	100 lb.	3.80 –	3.90
Soda, caustic, ground and flake, resale	100 lb.	3.72½ –	.....
Sodium acetate, works, bags	lb.	.05½ –	.06½
Sodium bicarbonate, bbl	100 lb.	2.00 –	2.50
Sodium bichromate, casks	lb.	.09 –	.09¼
Sodium bisulphate (niter cake)	ton	6.00 –	7.00
Sodium bisulphite, powd., U.S.P., bbl	lb.	.04½ –	.04½
Sodium chlorate, kegs	lb.	.06½ –	.07
Sodium chloride	long ton	12.00 –	13.00
Sodium cyanide, cases	lb.	.20 –	.23
Sodium fluoride, bbl	lb.	$0.09 –	$0.10½
Sodium hyposulphite, bbl	lb.	.02½ –	.03
Sodium nitrite, casks	lb.	.08 –	.08½
Sodium peroxide, powd., cases	lb.	.28 –	.30
Sodium phosphate, dibasic, bbl	lb.	.03½ –	.04
Sodium prussiate, yel. drums	lb.	.15 –	.16
Sodium salicylic, drums	lb.	.47 –	.52
Sodium silicate (40°, drums)	100 lb.	.80 –	1.25
Sodium silicate (60°, drums)	100 lb.	2.00 –	2.25
Sodium sulphide, fused, 60-62% drums	lb.	.04¼ –	.04½
Sodium sulphite, crys., bbl	lb.	.03½ –	.03¾
Strontium nitrate, powd., bbl.	lb.	.12½ –	.13
Sulphur chloride, yel drums.	lb.	.04½ –	.05
Sulphur, crude	ton	18.00 –	20.00
At mine, bulk	ton	16.00 –	18.00
Sulphur, flour, bag	100 lb.	2.25 –	2.35
Sulphur, roll, bag	100 lb.	2.00 –	2.10
Sulphur dioxide, liquid, cyl	lb.	.08 –	.08½
Talc—imported, bags	ton	30.00 –	40.00
Talc—domestic powd., bags.	ton	18.00 –	25.00
Tin bichloride, bbl	lb.	.12½ –	.13¾
Tin oxide, bbl	lb.	.48 –	.....
Tin crystals, bbl	lb.	.35½ –	.36
Zinc carbonate, bags	lb.	.14 –	.14½
Zinc chloride, gran, bbl	lb.	.06½ –	.06¾
Zinc cyanide, drums	lb.	.37 –	.38
Zinc oxide, , lead free, bbl	lb.	.08 –	.08½
5% lead sulphate, bags	lb.	.07½ –	......
10 to 35 % lead sulphate, bags	lb.	.07 –	......
French, red seal, bags	lb.	.09¾ –	......
French, green seal, bags	lb.	.10¾ –	......
French, white seal, bbl	lb.	.12 –	......
Zinc sulphate, bbl	100 lb.	2.50 –	3.00

Coal-Tar Products

Alpha-naphthol, crude, bbl	lb.	$0.65 –	$0.80
Alpha-naphthol, ref., bbl	lb.	.75 –	.90
Alpha-naphthylamine, bbl	lb.	.35 –	37
Aniline oil, drums	lb.	.16 –	.16½
Aniline salts, bbl	lb.	.23 –	.24
Anthracene, 80%, drums	lb.	.75 –	1.00
Anthracene, 80%, imp., drums, duty paid	lb.	.70 –	.75
Anthraquinone, 25%, paste, drums	lb.	.70 –	.75
Benzaldehyde U.S.P., carboys	lb.	1.40 –	1.45
tech, drums	lb	75	80
Benzene, pure, water-white, tanks and drums	gal.	.27 –	.32
Benzene, 90%, tanks & drums	gal.	.25 –	.30
Benzene, 90%, drums, resale	gal.	.28 –	.32
Benzidine base, bbl	lb.	.85 –	.90
Benzidine sulphate, bbl	lb.	.70 –	.75
Benzoic acid, U.S.P., kegs	lb.	.72 –	75
Benzoate of soda, U.S.P., bbl.	lb.	.57 –	.65
Benzyl chloride, 95-97%, ref., drums	lb.	.45 –	...
Benzyl chloride, tech., drums	lb.	.30 –	.35
Beta-naphthol, tech., bbl	lb.	.22 –	.23
Beta-naphthylamine, tech	lb.	.80 –	.90
Cresol, U.S.P., drums	lb.	.25 –	.29
Ortho-cresol, drums	lb.	.28 –	.30
Cresylic acid, 97%, resale, drums	gal.	1.15 –	1.20
95-97%, drums, resale	gal.	1.10 –	....
Dichlorbenzene, drums	lb.	.07 –	.09
Diethylaniline, drums	lb.	.50 –	.60
Dimethylaniline, drums	lb.	.42 –	.43
Dinitrobenzene, bbl,	lb.	.19 –	.20
Dinitroclorbenzenee bbl	lb.	.22 –	.23
Dinitronaphthalen, bbl	lb.	.30 –	.32
Dinitrophenol, bbl	lb.	.35 –	.40
Dinitrotoluene, bbl	lb.	.20 –	.22
Dip oil, 25%, drums	gal.	.25 –	.30
Diphenylamine, bbl	lb.	.50 –	.52
H-acid, bbl	lb.	.80 –	.85
Meta-phenylenediamine, bbl.	lb.	1.00 –	1.05
Michlers ketone, bbl	lb.	3.00 –	3.50
Monochlorbenzene, drums	lb.	.08 –	.10
Monoethylaniline, drums	lb.	.95 –	1.10
Naphthalene, flake, bbl	lb.	.08¾ –	.09
Naphthalene, balls, bbl	lb.	.09½ –	.10
Naphthionate of soda, bbl	lb.	.58 –	.65
Naphthionic acid, crude, bbl.	lb.	.55 –	.60
Nitrobenzene, drums	lb.	.10 –	.12
Nitro-naphthalene, bbl	lb.	.30 –	.35
Nitro-toluene, drums	lb.	.15 –	.17
N-W acid, bbl	lb.	1.25 –	1.30
Ortho-amidophenol, kegs	lb.	2.30 –	2.35
Ortho-dichlorbenzene, drums	lb.	.17 –	.20
Ortho-nitrophenol, bbl	lb.	.90 –	.92
Ortho-nitrotoluene, drums	lb.	.10 –	.12
Ortho-toluidine, bbl	lb.	.14 –	.15
Para-amidophenol, base, kegs	lb.	1.20 –	1.30
Para-amidophenol, HCl, kegs	lb.	1.25 –	1.35
Para-dichlorbenzene, bbl	lb.	.17 –	.20
Paranitroaniline, bbl	lb.	.72 –	.75
Para-nitrotoluene, bbl	lb.	.60 –	.65
Para-phenylenediamine, bbl.	lb.	1.45 –	1.50
Para-toluidine, bbl	lb.	.95 –	.98
Phthalic anhydride, bbl	lb.	.35 –	.38
Phenol, U.S.P., drums	lb.	.45 –	.50
Picric acid, bbl	lb.	.20 –	.22
Pyridine, dom., drums	gal.	nominal	

Pyridine, imp., drums	gal.	$2.50 – $2.75
Resorcinol, tech., kegs	lb.	1.40 – 1.50
Resorcinol, pure, kegs	lb.	2.00 – 2.25
R-salt, bbl	lb.	.55 – .60
Salicylic acid, tech., bbl	lb.	.37 – .42
Salicylic acid, U.S.P., bbl	lb.	.40 – .45
Solvent naphtha, water-white, drums	gal.	.27 – .32
Crude, drums	gal.	.24 – ....
Sulphanilic acid, crude, bbl	lb.	.18 – .20
Thiocarbanilide, kegs	lb.	.35 – .38
Toluidine, kegs	lb.	1.20 – 1.30
Toluidine, mixed, kegs	lb.	.30 – .35
Toluene, tank cars	gal.	.30 – .35
Toluene, drums	gal.	.35 – .40
Xylidines drums	lb.	.47 – .49
Xylene, pure, drums	gal.	.75 – 1.00
Xylene, com., drums	gal.	.37 – ....
Xylene, com., tanks	gal.	.32 – ....

Naval Stores

Rosin B-D, bbl	280 lb.	$5.90 – ....
Rosin E-I, bbl	280 lb.	6.00 – ....
Rosin K-N, bbl	280 lb.	6.20 – ....
Rosin W.G.-W.W., bbl	280 lb.	6.50 – 7.50
Wood rosin, bbl	280 lb.	6.00 – 6.10
Turpentine, spirits of, bbl	gal.	1.07 – 1.09
Wood, steam dist., bbl	gal.	1.00 – ....
Wood, dest. dist., bbl	gal.	.75 – ....
Pine tar pitch, bbl	200 lb.	.... – 6.00
Tar, kiln burned, bbl	500 lb.	.... – 13.00
Retort tar, bbl	500 lb.	.... – 12.00
Rosin oil, first run, bbl	gal.	.45 – ....
Rosin oil, second run, bbl	gal.	.48 – ....
Rosin oil, third run, bbl	gal.	.52 – ....
Pine oil, steam dist	gal.	.75 – ....
Pine oil, pure, dest. dist	gal.	.70 – ....
Pine tar oil, ref	gal.	.48 – ....
Pine tar oil, crude, tanks f.o.b. Jacksonville, Fla	gal.	.32 – .32½
Pine tar oil, double ref., bbl	gal.	.... – .75
Pine tar, ref., thin, bbl	gal.	.... – .25
Pinewood creosote, ref., bbl	gal.	.... – .52

Animal Oils and Fats

Degras, bbl	lb.	$0.03½ – $0.04½
Grease, yellow, bbl	lb.	.06½ – .07
Lard oil, Extra No. 1, bbl	gal.	.90 – .92
Neatsfoot oil 20 deg. bbl	gal.	1.30 – ....
No. 1, bbl	gal.	.92 – .94
Oleo Stearine	l.	.09 – ....
Red oil, distilled, d.p. bbl	lb.	.10½ – .10½
Saponified, bbl	lb.	.10½ – .10½
Tallow, extra, loose	lb.	.07½ – ....
Tallow oil, acidless, bbl	gal.	.94 – .96

Vegetable Oils

Castor oil, No. 3, bbl	lb.	$0.14 – ....
Castor oil, No. 1, bbl	lb.	.14½ – ....
Chinawood oil, bbl	lb.	.26 – .28
Coconut oil, Ceylon, bbl	lb.	.09½ – ....
Ceylon, tanks, N.Y	lb.	.08½ – ....
Coconut oil, Cochin, bbl	lb.	.09½ – .10
Corn oil, crude, bbl	lb.	.12½ – ....
Crude, tanks, (f.o.b. mill)	lb.	.09½ – ....
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.09½ – ....
Summer yellow, bbl	lb.	.12½ – ....
Winter yellow, bbl	lb.	.13 – .13½
Linseed oil, raw, car lots, bbl	gal.	1.12 – ....
Raw, tank cars (dom.)	gal.	1.07 – ....
Boiled, cars, bbl. (dom.)	gal.	1.14 – ....
Olive oil, denatured, bbl	gal.	1.10 – ....
Sulphur, (foots) bbl	lb.	.08½ – .09½
Palm, Lagos, casks	lb.	.07½ – .07½
Niger, casks	lb.	.07 – .07½
Palm kernel, bbl	lb.	.08½ – .08½
Peanut oil, crude, tanks (mill)	lb.	.13 – .13½
Peanut oil, refined, bbl	lb.	.16½ – ....
Perilla, bbl	lb.	.16 – .16½
Rapeseed oil, refined, bbl	gal.	.83 – .84
Rapeseed oil, blown, bbl	gal.	.88 – .89
Sesame, bbl	lb.	.11½ – .12
Soya bean (Manchurian), bbl	lb.	.12½ – .13
Tank, f.o.b. Pacific coast	lb.	.10½ – .10½
Tank, (f.o.b. N.Y.)	lb.	.10½ – .10½

Fish Oils

Cod, Newfoundland, bbl	gal.	$0.70 – $0.72
Menhaden, light pressed, bbl	gal.	.76 – ....
White bleached, bbl	gal.	.78 – ....
Blown, bbl	gal.	.82 – ....
Crude, tanks (f.o.b. factory)	gal.	.50 – ....
Whale No. 1 crude, tanks, coast	lb.	.... – ....
Winter, natural, bbl	gal.	.76 – .78
Winter, bleached, bbl	gal.	.79 – .80

Oil Cake and Meal

Coconut cake, bags	ton	$30.00 – $31.00
Copra, sun dried, bags, (c.i.f.)	lb.	.05 – .....
Sun dried Pacific coast	lb.	.04½ – .....
Cottonseed meal, f.o.b. mills	ton	38.00 – .....
Linseed cake, bags	ton	33.00 – 34.00
Linseed meal, bags	ton	35.00 – 36.00

Dye & Tanning Materials

Albumen, blood, bbl	lb.	$0.45 – $0.50
Albumen, egg, tech, kegs	lb.	.90 – .95
Cochineal, bags	lb.	.33 – .35
Cutch, Borneo, bales	lb.	.04½ – .05
Cutch, Rangoon, bales	lb.	.13 – .13½
Dextrine, corn, bags	100 lb.	3.69 – 4.01
Dextrine gum, bags	100 lb.	3.99 – 4.09
Divi-divi, bags	ton	38.00 – 39.00
Fustic, sticks	ton	30.00 – 35.00
Fustic, chips, bags	lb.	.04 – .05
Logwood, sticks	ton	26.00 – 30.00
Logwood, chips, bags	lb.	.02½ – .03½
Sumac, leaves, Sicily, bags	ton	70.00 – 72.00
Sumac, ground, bags	ton	$65.00 – $67.00
Sumac, domestic, bags	ton	40.00 – 42.00
Starch, corn, bags	100 lb.	2.97 – 3.07
Tapioca flour, bags	lb.	.06 – .06½

Extracts

Archil, conc., bbl	lb.	$0.17 – $0.18
Chestnut, 25% tannin, tanks	lb.	.02 – .03
Divi-divi, 25% tannin, bbl	lb.	.04 – .05
Fustic, crystals, bbl	lb.	.20 – .22
Fustic, liquid, 42°, bbl	lb.	.08 – .09
Gambier, liq., 25% tannin, bbl	lb.	.08 – .09
Hematine crys., bbl	lb.	.14 – .18
Hemlock, 25% tannin, bbl	lb.	.04 – .05
Hypernic, solid, drums	lb.	.24 – .26
Hypernic, liquid, 51°, bbl	lb.	.10 – .12
Logwood, crys., bbl	lb.	.18 – .20
Logwood, liq., 51°, bbl	lb.	.09 – .10
Quebracho, solid, 65% tannin, bbl	lb.	.04½ – .05
Sumac, dom., 51°, bbl	lb.	.06½ – .07

Dry Colors

Blacks-Carbongas, bags, f.o.b. works	lb.	$0.20 – $0.24
Lampblack, bbl	lb.	.12 – .40
Mineral, bulk	ton	35.00 – 45.00
Blues-Bronze, bbl	lb.	.55 – .60
Prussian, bbl	lb.	.55 – .60
Ultramarine, bbl	lb.	.08 – .35
Browns, Sienna, Ital., bbl	lb.	.06 – .14
Sienna, Domestic, bbl	lb.	.03½ – .04
Umber, Turkey, bbl	lb.	.04 – .04½
Greens-Chrome, C.P.Light, bbl	lb.	.32 – .34
Chrome, commercial, bbl	lb.	.12 – .12½
Paris, bulk	lb.	.30 – .35
Reds, Carmine No. 40, tins	lb.	4.50 – 4.70
Oxide red, casks	lb.	.10 – .14
Para toner, kegs	lb.	1.00 – 1.10
Vermilion, English, bbl	lb.	1.30 – 1.32
Yellow, Chrome, C.P. bbls	lb.	.20 – .21
Ocher, French, casks	lb.	.02½ – .03

Waxes

Bayberry, bbl	lb.	$0.35 – $0.36
Beeswax, crude, bags	lb.	.20 – .21
Beeswax, refined, light, bags	lb.	.32 – .34
Beeswax, pure white, cases	lb.	.40 – .41
Candellila, bags	lb.	.21 – .22
Carnauba, No. 1, bags	lb.	.42 – .43
No. 2, North Country, bags	lb.	.23 – .23½
No. 3, North Country, bags	lb.	.18½ – .19
Japan, cases	lb.	.16½ – .16½
Montan, crude, bags	lb.	.04½ – .04½
Paraffine, crude, match, 105-110 m.p.	lb.	.04 – .04½
Crude, scale 124-126 m.p., bags	lb.	.02½ – .03
Ref., 118-120 m.p., bags	lb.	.03 – .03½
Ref., 125 m.p., bags	lb.	.03½ – .03½
Ref, 128-130 m.p., bags	lb.	.03½ – .04
Ref., 133-135 m.p., bags	lb.	.04½ – .04½
Ref., 135-137 m.p., bags	lb.	.05 – .05½
Stearic acid, sgle pressed, bags	lb.	.13 – .13½
Double pressed, bags	lb.	.13½ – .13½
Triple pressed, bags	lb.	.15 – .15½

Fertilizers

Ammonium sulphate, bulk, f.o.b. works	100 lb.	$3.25 – $3.30
F.a.s. double bags	100 lb.	3.85 – 3.90
Blood, dried, bulk	unit	4.00 – ....
Bone, raw, 3 and 50, ground	ton	27.00 – 30.00
Fish scrap, dom., dried, wks	unit	3.75 – ....
Nitrate of soda, bags	100 lb.	2.52½ – 2.57½
Tankage, high grade, f.o.b. Chicago	unit	3.35 – 3.45
Phosphate rock, f.o.b. mines, Florida pebble, 68-72%	ton	$4.00 – $4.50
Tennessee, 78-80%	ton	8.00 – 8.25
Potassium muriate, 80%, bags	ton	34.55 – ....
Potassium sulphate, bags basis 90%	ton	43.67 – ....
Double manure salt	ton	25.72 — ......
Kainit	ton	7.22 — ......

Crude Rubber

Para—Upriver fine	lb.	$0.28½ – ....
Upriver coarse	lb.	.25 – ....
Upriver caucho ball	lb.	.26 – ....
Plantation—First latex crepe	lb.	.29 – ....
Ribbed smoked sheets	lb.	.29 – ....
Brown crepe, thin, clean	lb.	.27½ – ....
Amber crepe No. 1	lb.	.28½ – ....

Gums

Copal, Congo, amber, bags	lb.	$0.12 – $0.13
East Indian, bold, bags	lb.	.23 – .23½
Manila, pale, bags	lb.	.20 – .20½
Pontinak, No. 1 bags	lb.	.20 – .20½
Damar, Batavia, cases	lb.	.28 – .29
Singapore, No. 1, cases	lb.	.34 – .35
Singapore, No. 2, cases	lb.	.22 – .23
Kauri, No. 1, cases	lb.	.65 – .67
Ordinary chips, cases	lb.	.20 – .22
Manjak, Barbados, bags	lb.	.09 – .09½

Shellac

Shellac, orange fine, bags	lb.	$0.62 – $0.63
Orange superfine, bags	lb.	.64 – .65
A. C. garnet, bags	lb.	nominal
Bleached, bonedry	lb.	.71 – .72
Bleached, fresh	lb.	.59 – .60
T. N., bags	lb.	.58 – .59

Miscellaneous Materials

Asbestos, crude No. 1, f.o.b., Quebec	sh. ton	$500.00 – ....
Asbestos, shingle, f.o.b., Quebec	sh. ton	$65.00 – $85.00
Asbestos, cement, f.o.b., Quebec	sh. ton	20.00 – 25.00
Barytes, grd., white, f.o.b. mills, bbl	net ton	16.00 – 20.00
Barytes, grd., off-color, f.o.b. mills bulk	net ton	13.00 – 15.00
Barytes, floated, f.o.b. St. Louis, bbl	net ton	28.00 – ....
Barytes, crude f.o.b. mines, bulk	net ton	10.00 – 11.00
Casein, bbl., tech	lb.	.18½ – .20
China clay (kaolin) crude, f.o.b. Ga	net ton	7.00 – 9.00
Washed, f.o.b. Ga	net ton	8.00 – 9.00
Powd., f.o.b. Ga	net ton	14.00 – 20.00
Crude f.o.b. Va	net ton	8.00 – 12.00
Ground, f.o.b. Va	net ton	14.00 – 20.00
Imp., lump, bulk	net ton	15.00 – 20.00
Imp., powd	net ton	45.00 – 50.00
Feldspar, No. 1 pottery	long ton	6.00 – 7.00
No. 2 pottery	long ton	4.00 – 5.50
No. 1 soap	long ton	7.00 – 7.50
No. 1 Canadian, f.o.b. mill	long ton	20.00 – 22.00
Graphite, Ceylon, lump, first quality, bbl	lb.	.06½ – ....
Ceylon, chip, bbl	lb.	.05½ – ....
High grade amorphous crude	ton	15.00 – 35.00
Gum arabic, amber, sorts, bags	lb.	.14½ – .15
Gum tragacanth, sorts, bags	lb.	.48 – .56
No. 1, bags	lb.	1.50 – 1.60
Kieselguhr, f.o.b. Cal	ton	40.00 – 42.00
F.o.b. N. Y	ton	50.00 – 55.00
Magnesite, crude, f.o.b. Cal	ton	14.00 – 15.00
Pumice stone, imp., casks	lb.	.03 – .05½
Dom., lump, bbl	lb.	.05 – .05½
Dom., ground, bbl	lb.	.06 – .07
Silica, glass sand, f.o.b. Ind	ton	2.00 – 2.50
Silica, sand blast, f.o.b. Ind	ton	2.50 5.00
Silica, amorphous, 250-mesh, f.o.b. Ill	ton	17.00 – 17.50
Silica, bldg. sand, f.o.b. Pa	ton	2.00 – 2.75
Soapstone, coarse, f.o.b. Vt., bags	ton	7.00 – 8.00
Talc, 200 mesh, f.o.b., Vt., bags	ton	6.50 – 9.00
Talc, 200 mesh, f.o.b. Ga., bags	ton	7.00 – 9.00
Talc, 200 mesh, f.o.b. Los Angeles, bags	ton	16.00 – 20.00

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$3.25 – 3.50
Corning	bbl.	1.85 – ......
Cabell	bbl.	1.91 – ......
Somerset	bbl.	1.75 – ......
Illinois	bbl.	1.97 – ......
Indiana	bbl.	1.98 – ......
Kansas and Oklahoma, 28 deg.	bbl.	1.30 – ......
California, 35 deg. and up	bbl.	1.04 – ......

Gasoline, Etc.

Motor gasoline, steel bbls	gal.	$0.21½ – ......
Naphtha, V. M. & P. deod, steel bbls	gal	.20½ – ......
Kerosene, ref. tank wagon	gal.	.14 – ......
Bulk, W. W. export	gal.	.07 – ......
Lubricating oils:		
Cylinder, Penn., dark	gal.	.22 – .25
Bloomless, 30@31 grav	gal.	.18½ – .20½
Paraffin, pale	gal.	.24 – .26
Spindle, 200, pale	gal.	.22 – .24
Petrolatum, amber, bbls	lb.	.05 – .05½
Paraffine wax (see waxes)		

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	ton	$45–50
Chrome brick, f.o.b. Eastern shipping points	ton	50–52
Chrome cement, 40-50% Cr_2O_3	ton	23–27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks	1,000	40–46
2nd. quality, 9-in. shapes, f.o.b. wks	1,000	36–41
Magnesite brick, 9-in. straight (f.o.b. wks.)	ton	65–68
9-in. arches, wedges and keys	ton	80–85
Scraps and splits	ton	85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	48–50
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	48–50
F.o.b. Mt. Union, Pa	1,000	42–44
Silicon carbide refract. brick, 9-in.	1,000	1,100.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N. Y	ton	$200.00 – $225.00
Ferrochromium, per lb. of Cr, 6-8% C	lb.	.11½ .11½
4-6% C	lb.	.12 – .13
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	125.00 – ....
Spiegeleisen, 19-21% Mn	gr. ton	40.00 – ....
Ferromolybdenum, 50-60% Mo, per lb Mo	lb.	2.00 – 2.50
Ferrosilicon, 10-15%	gr. ton	48.00 – 50.00
50%	gr. ton	95.00 – ....
75%	gr. ton	150.00 – 160.00

Ferrotungsten, 70-80%, per lb. of W	lb.	$0.90 –	$0.95
Ferro-uranium, 35-50% of U. per lb. of U	lb.	6.00 –	....
Ferrovanadium, 30-40%, per lb. of V	lb.	3.50 –	3.75

Ores and Semi-finished Products

Bauxite, dom. crushed, dried, f.o.b. shipping points	ton	$6.00 –	$9.00
Chrome ore Calif. concentrates, 50% min. Cr_2O_3	ton	22.00 –	23.00
C.i.f. Atlantic seaboard	ton	20.50 –	24.00
Coke, fdry., f.o.b. ovens	ton	7.00 –	7.50
Coke, furnace, f.o.b. ovens	ton	6.00 –	6.50
Fluorspar, gravel, f.o.b. mines' Illinois	ton	20.00 –	21.50
Ilmenite, 52% TiO_2	lb.	.01¾–	.01½
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.33 –	....
Manganese ore, chemical (MnO_2)	ton	75.00 –	80.00
Molybdenite, 85% MoS_2, per lb. MoS_2, N. Y.	lb.	.65 –	.70
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 –	.08
Pyrites, Span., fines, c.i.f. Atl. seaport	unit	.11½–	.12
Pyrites, Span., furnace size, c.i.f. Atl. seaport	unit	.11½–	.12
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12	
Rutile, 95% TiO_2	lb.	.12 –	....
Tungsten, scheelite, 60% WO_3 and over, per unit WO_3	unit	8.50 –	8.75
Tungsten, wolframite, 60% WO_3 and over, per unit WO_3	unit	8.00 –	8.25
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 –	3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	2.25 –	2.50
Vanadium pentoxide, 99%	lb.	12.00 –	14.00
Vanadium ore, per lb. V_2O_5	lb.	1.00 –	....
Zircon, washed, iron free, f.o.b. Pablo, Fla.	lb.	.04½–	.13

Non-Ferrous Materials

	Cents per Lb.
Copper, electrolytic	14¾-15¼
Aluminum, 98 to 99%	26–27
Antimony, wholesale, Chinese and Japanese	7½– 8
Nickel, virgin metal	28–30
Nickel, ingot and shot	30–
Monel metal, shot and blocks	32.00
Monel metal, ingots	38.00
Monel metal, sheet bars	45.00
Tin, 5-ton lots, Straits	42.50
Lead, New York, spot	7.25
Lead, E. St. Louis, spot	7.05
Zinc, spot, New York	6.85
Zinc, spot, E. St. Louis	6.50

Other Metals

Silver (commercial)	oz.	$0.66
Cadmium	lb.	1.00
Bismuth (500 lb. lots)	lb.	2.55
Cobalt	lb.	2.65@2.85
Magnesium, ingots, 99%	lb.	1.25– .....
Platinum	oz.	114.00
Iridium	oz.	260.00@275.00
Palladium	oz.	80.00
Mercury	75 lb.	68.00

Finished Metal Products

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	24.25
Copper bottoms	29.75
Copper rods	25.25
High brass wire	19 37½
High brass rods	17.00
Low brass wire	21.10
Low brass rods	22.00
Brazed brass tubing	24.25
Brazed bronze tubing	29.00
Seamless copper tubing	25.25
Seamless high brass tubing	23.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

Copper, heavy and crucible	11.60@11.80
Copper, heavy and wire	11.50@11.60
Copper, light and bottoms	10.00@10.10
Lead, heavy	5.75@ 6 00
Lead, tea	3.50@ 3 75
Brass, heavy	6.50@ 6.75
Brass, light	5.75@ 6 00
No. 1 yellow brass turnings	6.75@ .700
Zinc	3.75@ 4.25

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	$3.29	$3.14
Soft steel bars	3.19	3.04
Soft steel bar shapes	3.19	3.04
Soft steel bands	3.29	3.19
Plates, ¼ to 1 in. thick	3.29	3.14

Industrial

Financial, Construction and Manufacturing News

Construction and Operation

Alabama

BIRMINGHAM—The Standard Sanitary Mfg. Co., Bessemer Bldg., Pittsburgh, Pa., manufacturer of sanitary enameled iron products, has acquired property at 5th Ave. and 22nd St., Birmingham, as a site for a new branch plant, estimated to cost about $100,000. Plans will be prepared at once.

PELHAM—The Superior Lime & Hydrate Co., Inc., has commenced the construction of a new hydrate lime-manufacturing plant with capacity of about 500 bbl. per day, estimated to cost close to $100,000 with machinery. A list of equipment to be installed is being arranged. H. C. Bridgewater is secretary and manager.

Arkansas

CAMDEN—The Morris Oil Co., recently organized by Harry Morris and associates, has concluded negotiations with the local Chamber of Commerce for a site for a new oil-refining plant, to have a capacity for handling 3,000 bbl. of crude petroleum per day. It is estimated to cost about $350,000, including machinery.

California

GLENDALE—The California Tylite Co., Inc., has work in progress on the first unit of a new plant near the junction of San Fernando Rd. and Vine St., to be equipped for the manufacture of concrete tile products under a special process. It will have an initial daily output of 30,000 tiles. Frank H. Boettcher is president; and Charles H. Davies, vice-president and general manager.

LOS ANGELES—The White Star Oil Co. has acquired property at Wilmington, Los Angeles Harbor, and plans for the construction of a new oil refinery to cost close to $1,000,000 with machinery. A gasoline refinery will also be installed. The company is operating oil properties at Santa Fe Springs, Cal.

LOS ANGELES—The Amargosa Talc Co., 224 Santa Fe Ave., has plans in preparation for the erection of a 1-story addition to its mill, 45x100 ft. Additional equipment will be installed.

Connecticut

SOUTHBURY—The Star Oil Co., Danbury, Conn., is planning for the construction of a new oil storage and distributing plant on local site, estimated to cost in excess of $75,000, with equipment.

Florida

BLOUNTSTOWN—The Florida Orchard & Packing Co., Thomasville, Ga., has tentative plans under consideration for the erection of a new plant for the manufacture of fertilizer products at its properties near Blountstown. W. H. Baxley, Blountstown, is president and general manager.

CANAL POINT—The Florida Sugar & Food Products Co., Lake Worth, Fla., has plans under way for extensions and improvements in its local sugar mill and properties, estimated to cost $350,000, including equipment. F. E. Bryant is head.

MIAMI—The Southern Alpha Tile Co. has preliminary plans under consideration for the erection of a new plant on local site for the manufacture of tile products, estimated to cost in excess of $50,000 with equipment. Allan J. Reynolds is president.

Illinois

GENESEO—The Tri-City Oil Co., 825 1st Ave., Rock Island, Ill., has tentative plans under consideration for the construction of a new oil storage and distributing plant on local site. A similar plant will also be erected at Erie, Ill. A list of equipment to be installed will be arranged at an early date. D. N. Johnson is president.

Iowa

DAVENPORT—The Linwood Stone & Cement Co., Kahl Bldg., has preliminary plans under way for the construction of a new cement-manufacturing plant to cost close to $200,000, including equipment. J. E. Schroeder is secretary.

Kansas

ARKANSAS CITY—The Roxana Petroleum Corp., St. Louis, Mo., will construct by day labor its proposed new oil-refining plant on property recently acquired. It will cost $400,000, including machinery. Sub-contracts will be let for equipment at once. E. R. Moore is construction manager in charge.

HUTCHINSON—The State Board of Administration has completed plans for the construction of a 1-story addition to its clay products manufacturing plant, 75x120 ft., estimated to cost $20,000, exclusive of equipment. C. M. Rutledge, State Capitol Bldg., Topeka, is state architect.

Louisiana

MONROE—The North American Carbon Co., Shreveport, recently organized with a capital of $200,000, has preliminary plans under consideration for the construction of a new plant in the vicinity of Monroe for the manufacture of carbon black. It is estimated to cost $80,000. C. W. Brown is president, and J. S. McCullough, vice-president.

Maryland

NORTH EAST—The North East Porcelain Co. has perfected plans for immediate operations at its new local plant, and will develop maximum capacity at an early date. The company was recently organized.

Massachusetts

LEOMINSTER—Fire, May 23, destroyed a portion of the celluloid and composition goods plant of the Standard Comb Co., with loss estimated at $25,000. It is planned to rebuild.

EAST WALPOLE—Bird & Son, Inc., manufacturer of prepared roofing products, has work nearing completion on a new plant addition, and plans to install equipment at an early date. It will cost in excess of $175,000.

Michigan

LANSING—The Dudley Paper Co., 740 East Shiawassee St., has plans prepared for extensions and improvements in its plant, including the installation of additional equipment, estimated to cost about $45,000. W. C. Dudley heads the company.

LUDINGTON—The Michigan Oil Development Co. recently organized with a capital of $500,000, is perfecting plans for the development of oil properties in the vicinity of Ludington and Manistee, and the construction of a new plant in this section. A stock issue of $100,000 has been arranged, the entire proceeds to be used for equipment and operations.

Mississippi

MERIDIAN—The Meridian Fiber Co. has completed plans and will commence the erection of an addition to its plant to cost about $40,000. It is purposed to install additional equipment to double, approximately, the present capacity.

New Jersey

GARFIELD—The Johnson Products Co., 138 Paris St., Newark, manufacturer of cellulose products, etc., has acquired the plant of the Newark Rubber Co., at Garfield, comprising a 1-story structure with about 20,000 sq.ft. of floor space. The new owner will make improvements in the factory and plans to occupy at an early date. Charles

Johnson is president; and H. C. Johnson, vice-president and treasurer.

NORTH MILLVILLE—Frederick & Dommock, Inc., has commenced the construction of a new local plant to be equipped for the manufacture of fine glass products, including vials, etc.

NUTLEY—The Texdel Chemical Co., 394 Claremont Ave., Jersey City, has leased a factory fronting on the Passaic River, Nutley, aggregating 12,000 sq.ft., and will use the structure for a new plant. Immediate possession will be taken and equipment installed.

JERSEY CITY—The Stratford Oakum Co., Cornelison Ave., has commissioned Dodge & Morrison, 160 Pearl St., New York, N. Y., architects, to prepare plans for extensions and improvements in its 1- and 2-story plant, to provide for increase in capacity.

New York

PORT HENRY—Witherbee, Sherman & Co., 2 Rector St., New York, operating local blast furnaces, plan for the immediate rebuilding of its ore-separating plant at Witherbee, near Port Henry, destroyed by fire, May 18, with loss estimated at $300,000, including crushing, separating and other machinery. The reconstruction is estimated to cost approximately the amount of the loss.

NEW YORK—The United States Steel Corp., 71 Broadway, New York, has acquired fluorspar properties in Crittenden County, Ky., and contemplates the installation of a complete mining plant and commercial reduction works.

NEW YORK—The Publicker Commercial Alcohol Co., Water and Snyder Sts., Philadelphia, Pa., has purchased the 6-story building at 433 Washington St., and will occupy the structure for a branch works.

Ohio

LIMA—The Radiant Oil Co., recently organized with a capital of $1,000,000, has preliminary plans under way for the erection of a new plant on local site for the manufacture of lubricating oils. The company has a 3-acre tract, and will also construct a laboratory and preliminary compounding mill; the initial plant units will cost approximately $250,000, with machinery. At a later date it is purposed to construct a gasoline-refining plant, adjoining the present structures. E. E. Bessire is vice-president and general manager.

EAST AKRON—The Rote Leather Products Co., Doyle Block, Akron, has negotiations nearing completion for the purchase of the plant of the Phoenix Rubber Co., inactive for a number of months past, for a consideration said to be $150,000. The Rote company will remodel and improve the factory, and install equipment for the manufacture of leather substitute products.

CLEVELAND—The Standard Oil Co. has preliminary plans under consideration for the construction of a new storage and distributing plant on 3-acre tract of land on the Berea Rd., near Fischer Rd., recently acquired for a consideration of $21,000. It is estimated to cost in excess of $75,000, with equipment.

Pennsylvania

PHILADELPHIA—The R. E. Tongue & Brothers Co., Amber and Allegheny Sts., manufacturer of glass products, has work in progress on a new plant addition to cost about $60,000, and plans to install equipment at an early date.

LEWISTON—The Pennsylvania Wire Glass Co., Pennsylvania Bldg., is perfecting plans for the construction of the initial unit of its proposed new plant on property recently acquired at Lewiston, estimated to cost about $80,000, with equipment. Other units will be built later. Frank L. Martin is head.

PHILADELPHIA—The Pennsylvania Salt Mfg. Co., Widener Bldg., has filed plans for a 1-story extension at its plant at Porter and Delaware Sts.

NORTHAMPTON—The Atlas Portland Cement Co. has negotiations nearing consummation for the purchase of the plant of the Western States Portland Cement Co., Independence, Kan., and plans to take over the mill at an early date. Extensions and improvements will be made, including the installation of additional equipment.

UNIVERSAL—The Universal Portland Cement Co. has purchased a tract of 230 acres of land heretofore held by the Carnegie Steel Co., including its plant site and adjoining property, for a consideration said to be in excess of $2,000,000, and will utilize for general operations and expansion.

Texas

BEAUMONT—The Atlantic Refining Co., 3144 Passyunk Ave., Philadelphia, has commenced preliminary work for the construction of its proposed local oil-refining plant, estimated to cost in excess of $300,000, and purposes to inaugurate building erection at an early date.

DALLAS—The Camel Chemical Co., Portland, Ore., C. W. Hall, president, has organized the Camel Chemical Co. of Texas, as a subsidiary company, to operate a local plant. One of the former buildings of the government in the Love Aviation Field, near Dallas, has been acquired and will be remodeled and improved for an initial plant, to specialize in the manufacture of a chemical solution for battery service. Alexander D. Hudson is head of the subsidiary company.

PARIS—The Blossom Cotton Oil Co. has abandoned plans for the proposed rebuilding of the portion of its local mill destroyed by fire a number of months ago, and it is purposed to dissolve the company.

TEXAS CITY—The Texas Sugar Refining Co. has work in progress on its proposed local refining plant, and plans to have the initial buildings ready for the machinery installation at an early date. The new refinery will cost in excess of $300,000. E. T. Thomas, engineer for the company, is in charge.

New Companies

LEBANNON CHEMICAL CO., Pawtucket, R. I.; chemical products; $10,000. Incorporators: Eugene X. Murphy, James Hand and Edward J. Duffy, 47 Kepler St., Pawtucket.

INTER-CONTINENTAL TIRE & RUBBER CO., Indianapolis, Ind.; tires and rubber products; 200,000 shares of stock, no par value. Incorporators: J. D. Wiggings, S. T. Davis and Herbert W. Lantz, all of Indianapolis.

LINDEN CHEMICAL PRODUCTS CO., New York, N. Y.; chemicals and chemical byproducts; $50,000. Incorporators: M. and J. M. Marshall. Representative: E. B. Schulkind, 2 Rector St., New York.

EAST TENNESSEE CHEMICAL CO., Etowah, Tenn.; chemicals and chemical byproducts; $100,000. Incorporators: W. H. Chancey, Paul H. Snapp and F. T. Purdue, all of Etowah.

HILLCREST SANITARY SPECIALTY MFG. CO., Trenton, N. J.; sanitary pottery products; $50,000. Incorporators: Herman A. Janach, Martin Boller and Frank Schuh, Homan and Hilton Sts., Trenton. The last noted is representative.

PAINT PIGMENT CO. OF AMERICA, INC., Wilmington, Del.; paint pigments, etc.; $150,000. Representative: United States Corporation Co., Dover, Del.

SOFT PHOSPHATE FERTILIZER CO., Tampa, Fla.; fertilizer products; organized. William G. Brooks, president; and Samuel Borchardt, secretary, both of Tampa.

BARBER TANNING CO., North Adams, Mass.; operate a leather tannery; $250,000. Oliver Hall is president, and George E. Cox, North Adams, treasurer and representative.

HILL CHEMICAL CO., Wilmington, Del.; chemicals and chemical byproducts; $1,000,000. Representative: Corporation Service Co., Equitable Bldg., Wilmington.

PARA CORP., Belleville, N. J.; chemicals and chemical byproducts; $20,000. Incorporators: Walter H. and J. W. Zillessen, and Edward G. Meyers, 372 Main St., Belleville. The last noted is representative.

REVELLE OIL CO., Bristow, Okla.; petroleum products; $100,000. Incorporators: E. H. Rollestone, Bristow; C. E. Strouvelle and C. P. Davis, both of Tulsa, Okla.

METASCALE PROCESS CO., Detroit, Mich.; metal processing for scale removal; $50,000. Incorporators: Oscar M. Howard, Martin E. Ball and Joseph A. Hammer, 4301 Allendale St., Detroit. The last noted is representative.

CONTINENTAL CHEMICAL CO., Lakewood, O.; chemicals and chemical byproducts; $10,000. Incorporators: Harvey E. Miller and William H. Chapman, both of Lakewood.

WATERPROOFING, INC., Indianapolis, Ind.; waterproofing compounds, etc.; $100,000. Incorporators: James A. Walsh, Frank K. Bull and Lee R. Garber, all of Indianapolis.

C. H. A. SCHMITT CO., Boston, Mass.; chemicals and chemical byproducts; 400 shares of stock, no par values. Charles A. Schmitt, president; and Philip J. Kraft, Boston, treasurer.

INSULATING PRODUCTS CO., 412 North Western Ave., Chicago, Ill.; compounds; $40,000. Incorporators: Louis Weber, William J. Greer and Fred Elizer.

MARR OIL CORP., 101 East Fayette St., Baltimore, Md.; refined petroleum products; 500,000 shares of stock, no par value. Incorporators: John J. Hopkins, Carl W. Painter and J. Donald Robb.

PROTECTION PAINT & PRODUCTS CORP., 8 South Dearborn St., Chicago, Ill.; paints, varnishes, oils, etc.; $25,000. Incorporators: Mortimer A. Sherick, A. B. Sherick, and Henry Rutz.

EX-OIL CHEMICAL PRODUCTS CO., Jersey City, N. J.; chemicals and chemical byproducts; $100,000. Incorporators: Francis I. Golden, Alexander Mannix and James H. Sharkey, 225 Claremont Ave., Jersey City. The last noted is representative.

FARMÂSTIC CO., Haverford, Pa.; paints, varnishes, etc.; $250,000. Incorporators: Frank A. Cabeen, Jr., Haverford; George G. Meade, Ambler, Pa.; and W. F. Diener, Collingswood, N. J. Representative: United States Corporation Co., Pennsylvania Bldg., Philadelphia, Pa.

CONSOLIDATED BOLL WEEVIL & INSECT DESTROYER CO., Blanchard, Okla.; chemical compounds; $25,000. Incorporators: John A. Stephenson, D. C. Morgan and T. C. Laws, all of Blanchard.

DALCO LUBRICANTS, INC., Wilmington, Del.; oils and greases; $120,000. Representative: Corporation Service Co., Equitable Bldg., Wilmington.

FINDLAY-EAGLE OIL CO., Findlay, O.; oil products; $25,000. Incorporators: W. E. Stephenson and M. H. Shaffer, both of Findlay.

LASTIK PRODUCTS CO., Beaver, Pa.; cements, paints, etc.; now being organized, application for a state charter will be made June 6. Incorporators: E. A. Holland, J. deS. Freund and S. B. Myers. Representative: Hice, Morrison, May & Bradshaw, Beaver.

Industrial Notes

THE WHEELING STEEL PRODUCTS CO. (sales company for the La Belle Iron Works, Whitaker-Glessner Co. and Wheeling Steel & Iron Co.) discontinued May 1, and the Wheeling Steel Corp., from that date, has handled all sales. The Wheeling Steel Corp. will assume all existing sales obligations of the Wheeling Steel Products Co., Wheeling, W. Va., and of the three above-named companies. This action will not affect the personnel of the sales division, which will remain unchanged at Wheeling and at district sales offices.

THE CONVEYORS CORP. OF AMERICA, Chicago, Ill., announces the appointment of the Pittsburgh Machine Products Co., Oliver Bldg., Pittsburgh, Pa., as district representative.

Since May 15 the firm of PETREE & DORR has occupied separate office from the Dorr Co. in the Munson Bldg., 67 Wall St., New York City, and has enlarged its staff. P. M. McHugh, until now vice-president and manager of sales of equipment for the Dorr Co., will become president and general manager of Petree & Dorr. C. G. Petree of Brisbane, Australia, will become vice-president and consulting engineer. J. V. N. Dorr, president of the Dorr Co., will be chairman of the board of directors. H. E. Haws, treasurer of the Dorr Co., will continue as treasurer for the present. G. C. Kaar will continue in charge of the office in Havana.

THE WEBSTER MFG. CO., Chicago, Ill., announces the appointment of Robert T. Pierce as manager of its New York sales office at 90 West St., succeeding Glen N. Porter, deceased.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

LINSEED OIL, coconut oil and palm kernel oil, 10 to 50 tons of each, all of the best quality. Wurttemberg, Germany. Purchase.—6497.

EDIBLE OILS AND LARD. Vienna, Austria. Purchase.—6502.

VEGETABLE OILS AND LARD. Prague, Czechoslovakia. Purchase.—6517.

WINDOW GLASS AND CAUSTIC SODA. Rio Grande do Sul, Brazil. Manufacturers' agency.—6543.

VARNISHES AND PAINTS, hard aluminum. Madrid, Spain. Purchase.—6594.